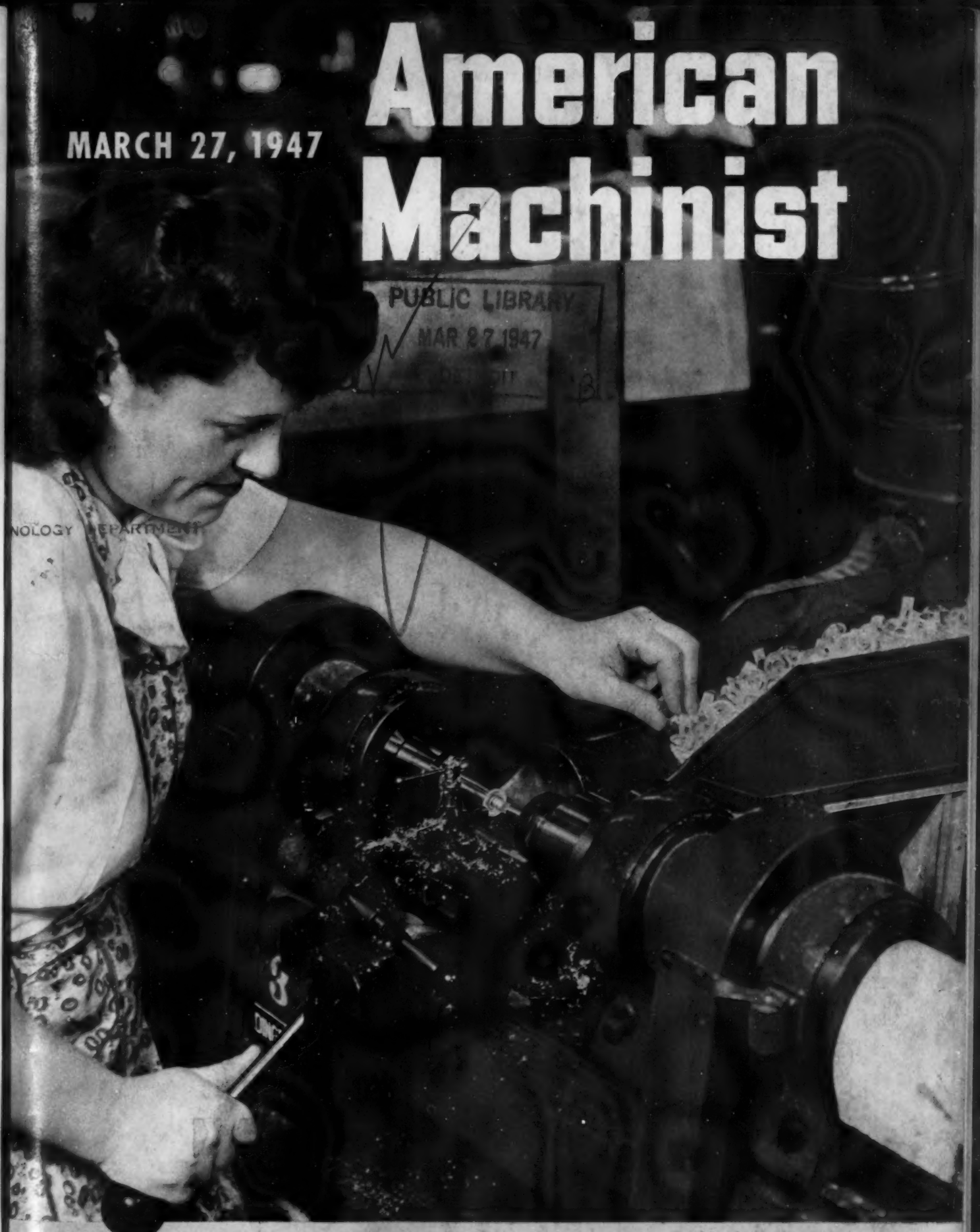

American Machinist

MARCH 27, 1947

In this issue

- Cast Stainless Molds Cut Plastics Costs
- Automatic Handling Speeds Plating
- Drawing Triple-Thick Bottoms in Aluminum

How to grind (1) automatically (2) for perfect concentricity (3) at less cost

. . . on a Heald No. 81 Centerless Internal

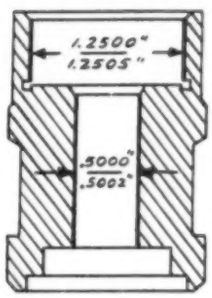

Diagram of a hydrostatic valve as ground on a Heald No. 81 Centerless equipped with combination Heald Gage-Matic and Size-Matic controls. This machine automatically grinds open bore (Gage-Matically) and blind bore (Size-Matically) perfectly concentric with each other and both concentric to the outside diameter within .0002" total indicator reading.

A VALVE MANUFACTURER was faced with the problem of how to attain close tolerances on a mass production basis, and still keep his grinding costs down.

Heald had the answer—in a No. 81 Centerless Internal. This machine is completely automatic from the moment the operator fills the chute. It loads automatically, grinds automatically, sizes Gage-Matically or Size-Matically, and ejects the finished work automatically. All of which means faster preset cycles, faster production, and *automatic* accuracy.

Now this manufacturer gets sure results without any wasted effort, and with a minimum of operator attention. And Centerless grinding allows him to rechuck work quickly and easily, without the slightest possibility of error. Since he grinds two concentric bores in each valve (illustrated at left), in two consecutive setups, this chuckless method of grinding helps him to save time and cut production costs.

Perhaps you have a job that can be handled more economically on a completely automatic No. 81 Centerless Internal. For further information, get in touch with the Heald branch office nearest you, or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision . . . less cost

Branch Offices at Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Diamond Machines Plastic . . . Finishing of Lucite mouthpieces for plastic musical instruments at Boonton (N. J.) Molding Company makes our colorful cover subject. In the Hardinge precision bench lathe is a diamond-tipped chamfering tool for high production. Cutting is done without coolant, hence the dust-exhaust system. Kodachrome by McGraw-Hill Studios.

Bow to Plastics Fabrication . . . Our cover, and our special report, symbolize the forthcoming Plastics Show (early May). The special report deals with design and use of cast stainless-steel molds for plastics. This is a brand-new method of producing stainless "cavities," joining the older methods of hubbing and machining from solid.

Tricky Drawing . . . Special techniques in ironing and bulging are required to draw an aluminum kettle or pot with sides a third as thick as the bottom. Birdsall of Reynolds Metals describes the dies and methods in our lead article —the first time these trade secrets have been told.

Old Reliable? . . . We talked the other day with a company which has recently supplied one of those Rube Goldberg transfer machines. All of the carbides, electronic controls, handling devices and other new-fangled gadgets are working perfectly . . . The only trouble that has developed is with the old reliable high-speed-steel toolbits on one slow-speed boring cut.

Broaching . . . In addition to the tool engineering represented in drawing and rolling dies and plastic molds, this issue includes suggestions on broaching from Colonial Broach and a page on controlling dust from grinding operations . . . there's also the fourth and last part of David Armstrong's series on fundamentals of quality control.

Filer's Convenience . . . For those readers who must pass on their copies or keep them intact, we can provide reprints of special reports as long as our supplies last. Costs are 10 to 15 cents each, depending on number of pages. Some are out of stock, however —quantity demands from schools and apprentice-training supervisors, manufacturers and plant executives.

Silent Salesman . . . Ever see one of those booklets, with cross-sections of the human body, printed on sheets of cellophane and registered so you can "peel" the layers? R. K. LeBlond has done the same thing on its dual-drive lathe. This booklet takes the lathe apart step by step to give unique portrayal.

Can-roll Project . . . Hard surfacing on forming and trimming rolls, piercing and other tools assures long-term service in making steel containers. Tools are pictured, each with an explanatory sketch, in a picture-and-caption article in this issue.

Coming . . . For a year, more or less, we have been studying the subject of forging, attempting to draw the tenuous line between it and forming, to establish subdivisions, to condense available data into practical form. The first of two 16-page special reports on the subject, by Associate Editor Ashburn, appears in *A.M.* for April 10, deals with equipment; the second, in May 8, will deal with tooling and methods.

To recognize the passing of April Fool's Day, we will also include a spread of first-year-apprentice boners. The inside story on forming a 16-ft., 50-lb. magnesium canoe; shop shots on tooling for production of a cast-iron gear sector . . . Other subjects: grievance procedure, broaching at AC Sparkplug, measurement of surface finish, simplified production control at Barrett-Cravens, wage incentives at Reed-Prentice Corporation.

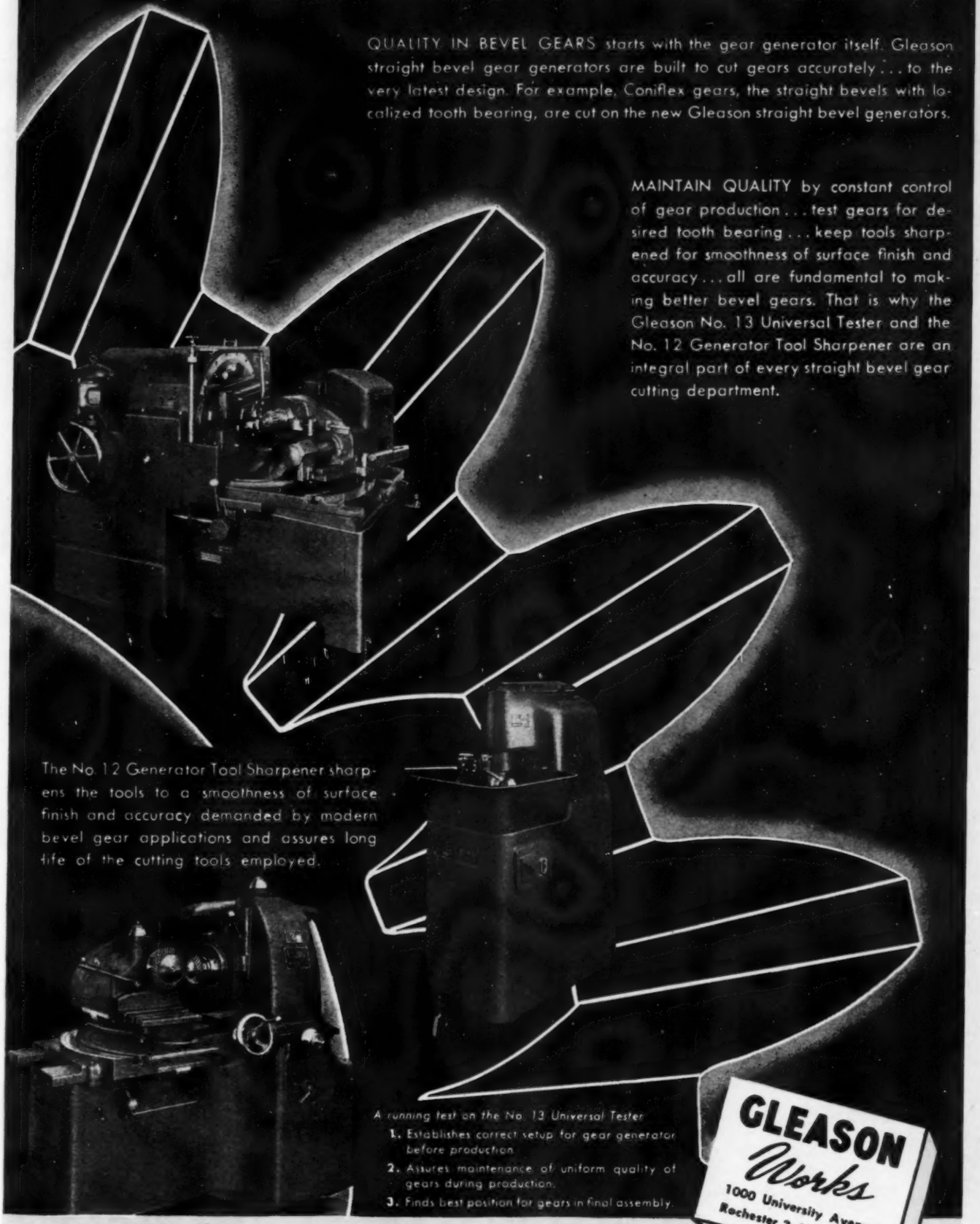
KILROY IS HERE . . . Responsible for all phases of design, engineering and installation of the plating department at Daystrom Corporation, Olean, N. Y., M. E. Kilroy has the title of plating superintendent, and is the author of our current article on automatic handling for plating.

He received his B.S. Ch. E. from Michigan in 1934, and became control chemist in the lab. of Cowles Detergent, Lockport, N. Y. Early in 1936, he became asst. to the supt. of plating, Stamping Div., Eaton Mfg. Co., Cleveland, and two years later took charge of plating there. In this capacity, he designed and installed a completely new full-automatic plating dept., and acted as consultant for other Eaton divisions. In April, 1943, he became plating supt. for United Platers, Inc., and transferred to his present position in December, 1944.

MAINTAIN QUALITY

QUALITY IN BEVEL GEARS starts with the gear generator itself. Gleason straight bevel gear generators are built to cut gears accurately . . . to the very latest design. For example, Coniflex gears, the straight bevels with localized tooth bearing, are cut on the new Gleason straight bevel generators.

MAINTAIN QUALITY by constant control of gear production . . . test gears for desired tooth bearing . . . keep tools sharpened for smoothness of surface finish and accuracy . . . all are fundamental to making better bevel gears. That is why the Gleason No. 13 Universal Tester and the No. 12 Generator Tool Sharpener are an integral part of every straight bevel gear cutting department.



The No. 12 Generator Tool Sharpener sharpens the tools to a smoothness of surface finish and accuracy demanded by modern bevel gear applications and assures long life of the cutting tools employed.

A running test on the No. 13 Universal Tester

1. Establishes correct setup for gear generator before production.
2. Assures maintenance of uniform quality of gears during production.
3. Finds best position for gears in final assembly.

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U.S.A.

Builders of Bevel Gear Machinery for Over Eighty Years

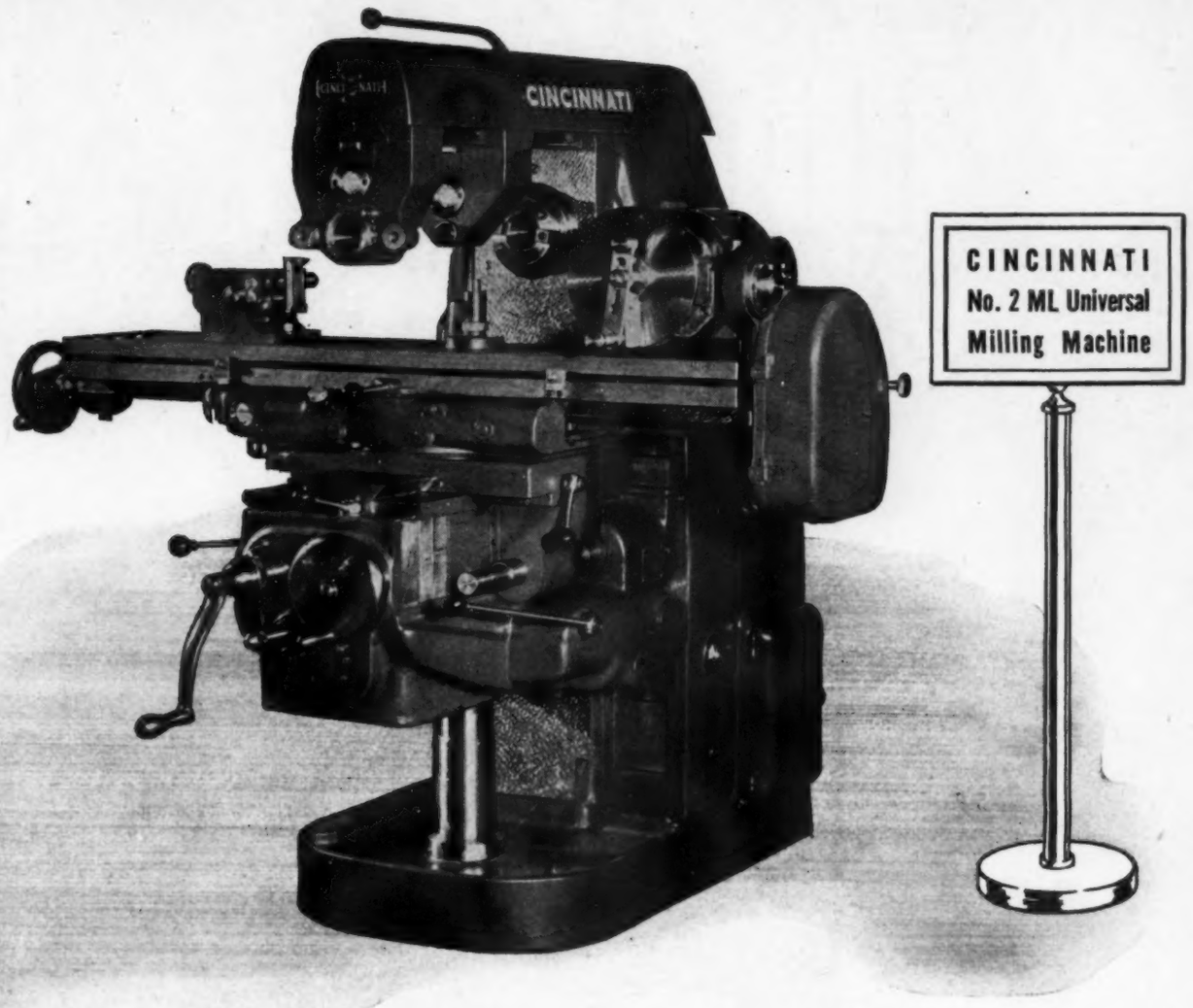
The No. 2 ML

A NEW ADDITION TO THE CINCINNATI LINE OF GENERAL PURPOSE MILLING MACHINES

CINCINNATI

THE CINCINNATI MILLING

MILLING MACHINES



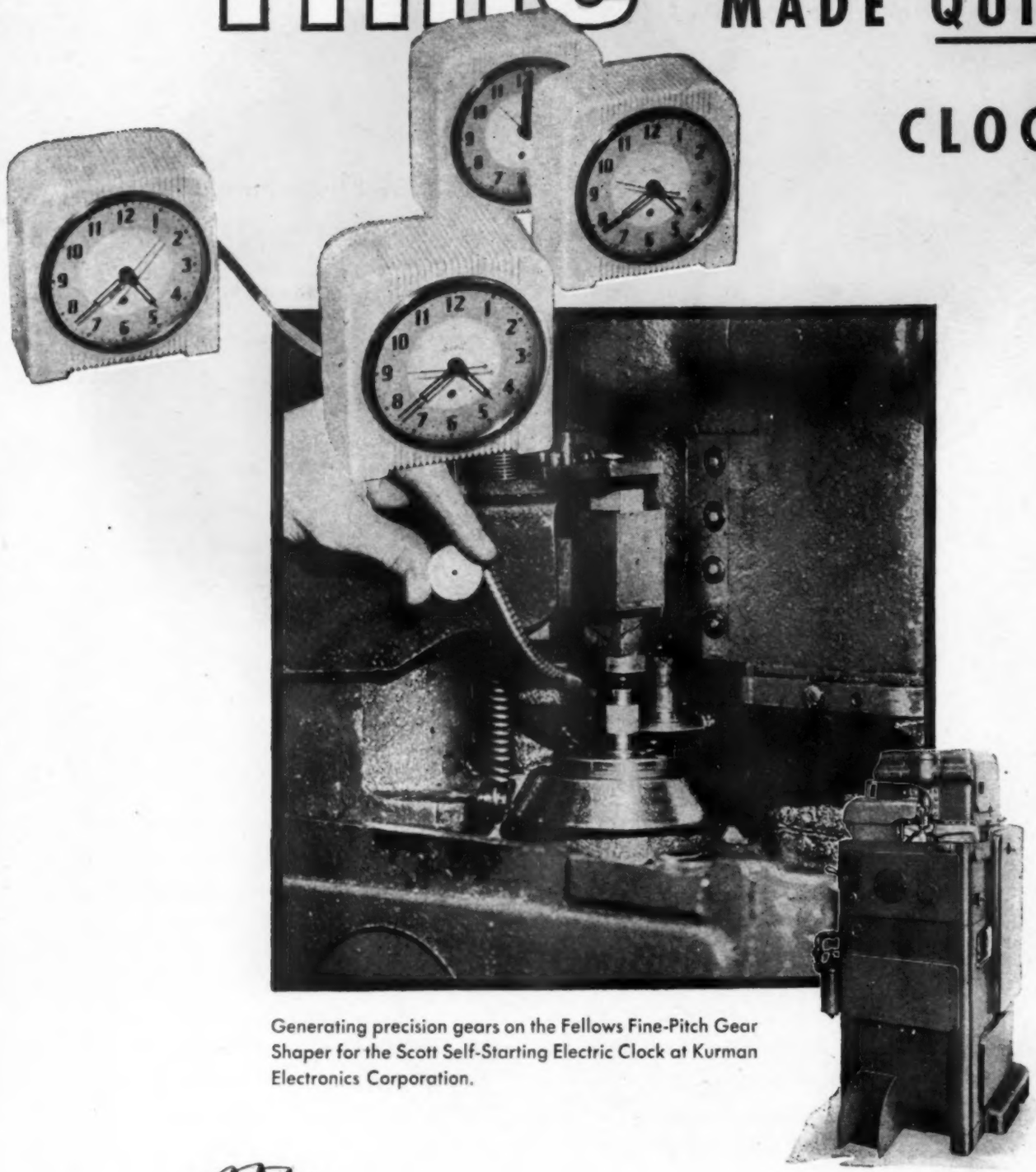
Here's a new milling machine — the CINCINNATI No. 2 ML — that's just right for your milling operations within 3 h.p. cutting capacity on a variety of work. ¶It's a companion machine to the popular No. 2 MI. Quite naturally, it has all the features of the No. 2 MI, and offers all the advantages so important to economical shop practice. Through wide speed and feed ranges, it offers top cutting efficiency when using small two-lip end mills or fairly large face mills. You'll appreciate the ¼" feed rate for mill-saw operations on high speed steel; or the 30" feed rate when routing out an aluminum pattern. There are many other cost-reducing features, too. And operators like the 2 ML because it's safe, it's easy to operate, it requires a minimum of daily service attention. ¶May we send complete information to you? The 2 ML's are built in Plain and Universal styles. Write for catalog M-1507-1.

MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

Time MADE QUIET..

CLOCK G



Generating precision gears on the Fellows Fine-Pitch Gear Shaper for the Scott Self-Starting Electric Clock at Kurman Electronics Corporation.

THE FELLOWS METHOD..MACHINES AND TOOLS FOR

ET..BY PRECISION

K GEARS

Long-wearing and QUIET-operating gears are a sales virtue of well-made Electric Clocks through high-accuracy parts, mass produced on the Fellows Fine-Pitch Gear Shaper.

War-time advancements in the precision generating of fine-pitch instrument gears has been rapidly adapted to the improvement of many products. Modern precision gears of high-involute accuracy—as fine as 64, 80, or even 200 pitch—are contributing substantially to increased serviceability of a variety of products... clocks, meters, microscopes, motion-picture cameras, and many other precision devices.

The Fellows Fine-Pitch Gear Shaper has played an important part. With cutter speeds up to 2,000 strokes per minute, and the ganging of blanks on arbors, production rates top those of even sub-press dies. On a cost-per-piece, or tooth precision basis, the Gear Shaper sets new standards. Our Sales Engineers will be glad to show you how Gear Shaper precision will contribute to the salability of your products.

★ ★ ★

Ask for our 64-page illustrated booklet "The Fellows Method". The Fellows Gear Shaper Company. Head Office and Export Dept.... Springfield, Vermont, U.S.A.... Branch Offices...616 Fisher Building, Detroit, Michigan ...or 640 West Town Office Building, Chicago, Illinois.

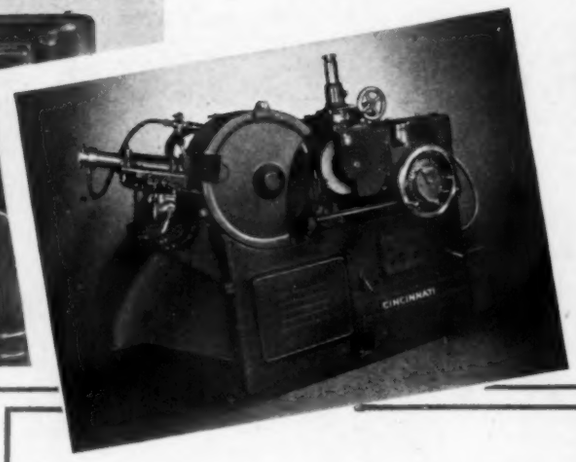
Fellows

● **HAVE YOU SEEN** the latest in gear science... the Fellows sound motion picture in natural color..."Highlights of the Art of Generating and Gear Manufacturing Equipment." Contact Springfield, Vermont, or our local offices for booking appointments.

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

Grinding the ends of a rear axle housing on a CINCINNATI FILMATIC No. 3 Centerless Grinder equipped with Outboard Roller Work Rest.

CINCINNATI FILMATIC No. 3 Centerless Grinding Machine. Capacity up to 6" diameter. Ask for catalog G-438-3.



whatever the size or shape of the part you can grind it on a...

CINCINNATI

● The parts you produce may not be like those in the illustrations . . . studs for movie cameras, banjo axle housings, or bowling balls . . . but if they are cylindrical or spherical, chances are you can handle them to better advantage, and at lower cost, on CINCINNATI FILMATIC Centerless Grinding Machines. ¶Cincinnati Centerless Application Engineers, knowing the importance of all the factors in the selection and development of low-cost grinding equipment, have perfected hundreds of ingenious methods of finishing parts better, faster and more economically. The services of these engineers are available to help you select the right equipment and apply the proper technique to your work. ¶CINCINNATI Centerless Grinders are made in three standard sizes: Nos. 2, 3 and 4; larger and smaller sizes also available.

CINCINNATI GRINDERS

CENTER TYPE GRINDING MACHINES

A CINCINNATI FILMATIC No. 2 Centerless, using the infeed method, grinds the bearing diameter of lever studs for movie cameras. These parts are only ¼" long. Production is 300 per hour.

CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Capacity 1/16" to 3½" diameter. Catalog G-456-4.

FILMATIC CENTERLESS

Grinding bowling balls by the centerless method. Net production is almost 17 per hour. The machine is a CINCINNATI FILMATIC No. 4 Centerless.

CINCINNATI

CINCINNATI FILMATIC No. 4 Centerless Grinding Machine. Capacity up to 9" diameter. Catalog G-538.

INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

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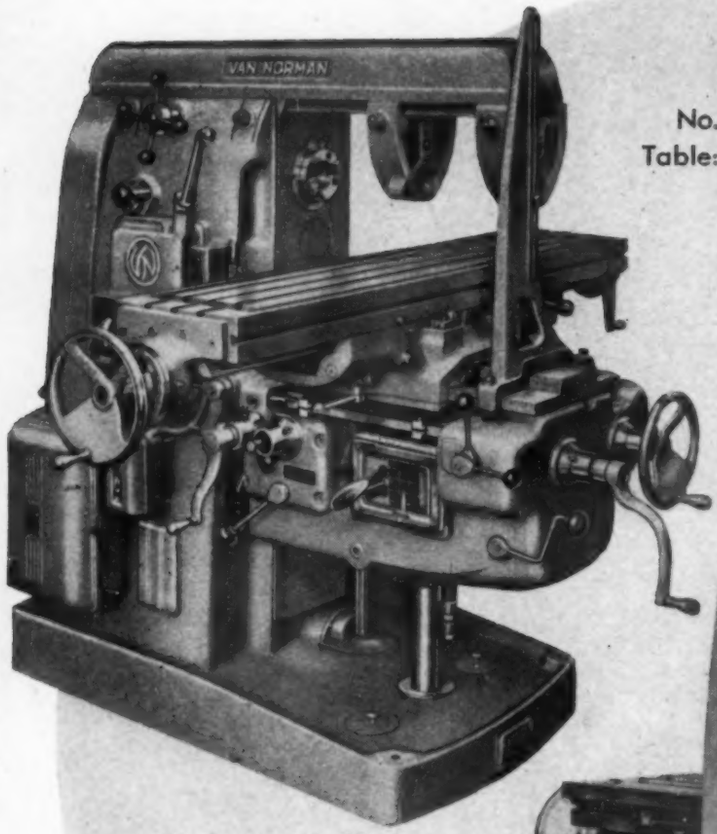
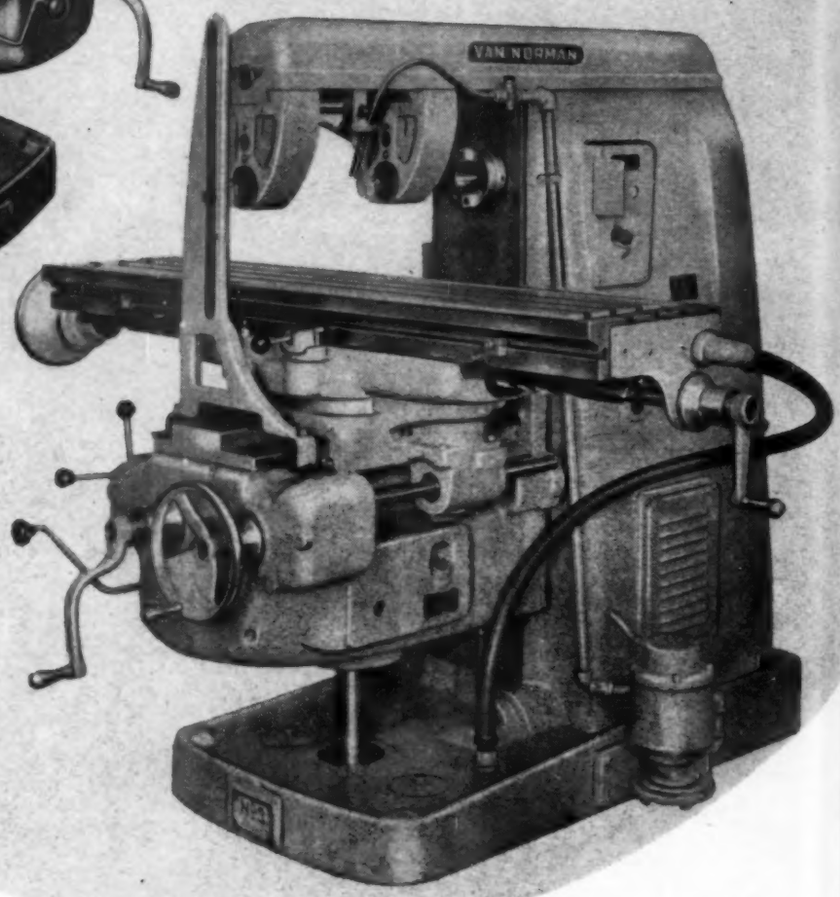
For Improved Cutability



No. 2 Heavy
Table: 58 x 13 in.



No. 3 Standard
Table: 64 x 14 in.

"It pays to Van Normanize"

That Increases Production

IT'S

VAN NORMAN

Horizontal Milling Machines

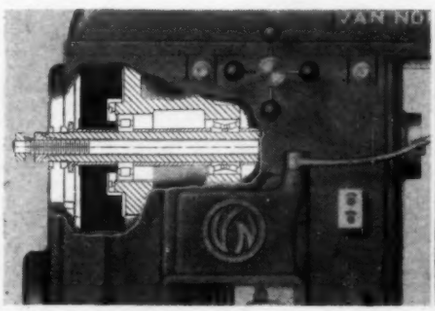
The new Van Norman Horizontal Milling Machines No. 2 Heavy and No. 3 Standard feature a heavy built-in spindle flywheel that provides smooth uninterrupted transmission of power to the cutter. This outstanding design advantage increases cutability and improves quality of finish of work produced on these machines.

The new heavy-duty spindle is supported by five anti-friction bearings assuring maximum spindle rigidity under the heaviest of cuts.

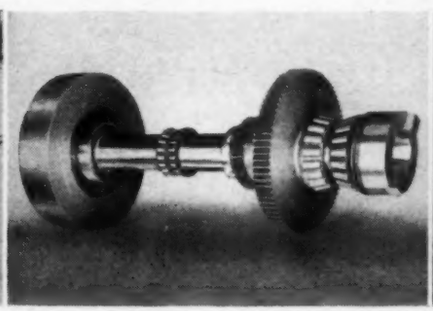
Other Van Norman advantages include . . .

Front and rear hand, power, and rapid traverse controls, single lever feed and speed selectors, overarm pilot wheel, large easy-to-read dials, automatic lubrication, hardened alloy steel gears with large tooth area and heavy rugged column and base.

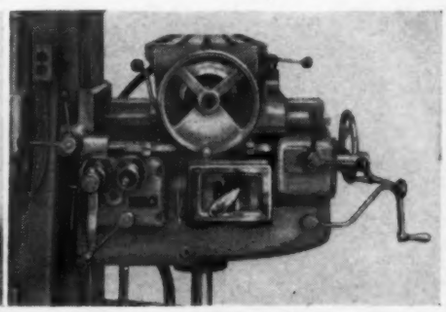
The Van Norman No. 2 Heavy and No. 3 Standard are available with plain or universal saddles. Write for information, today.



BUILT-IN SPINDLE FLYWHEEL, mounted on spindle inside the column, assures uniform uninterrupted transmission of power to cutter. The heavy flywheel increases and improves cutability . . . permits smoother finish of work surface.



5 ANTI-FRICTION BEARINGS support the large diameter alloy steel spindle. They maintain accuracy by assuring maximum spindle strength and rigidity under every type of cut.



FRONT AND REAR CONTROL of fingertip power and six-way rapid traverse levers and manual adjustments simplifies operation. Directional power controls provide maximum work and operator safety.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

An Ideal Threading Combination

. . The LANDMACO For Large Precision Work

. . The 3/8" HIGH SPEED For Small Parts

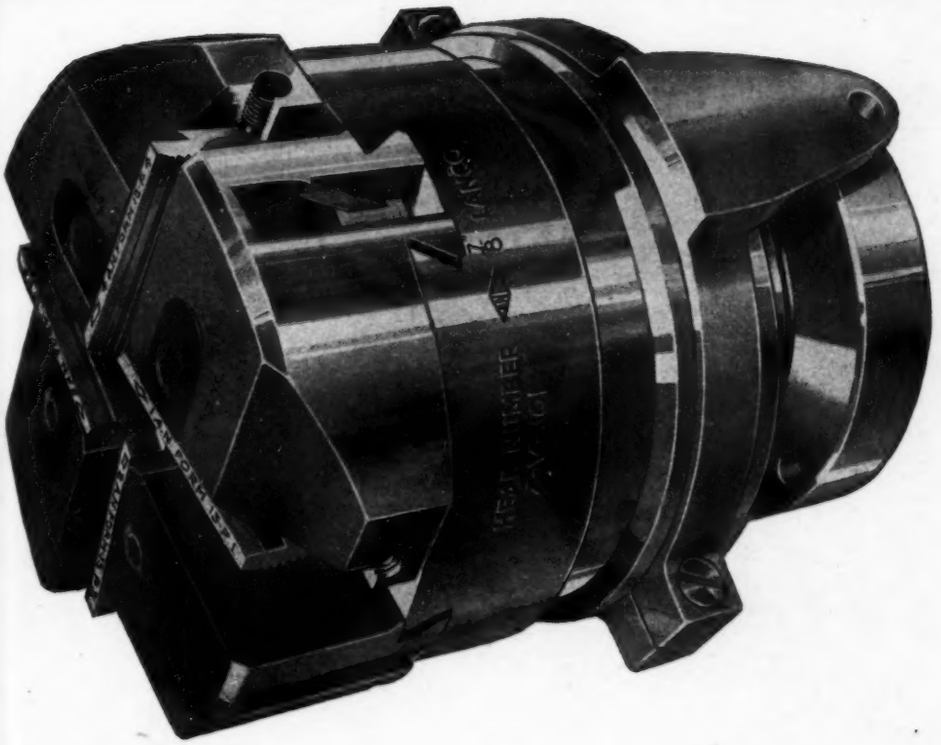
For manufacturers of screw machine products and other small threaded components, the efficiency of this combination is clearly demonstrated by the production records of the machines illustrated. Threading 5/8" diameter 24 pitch threads to class three specifications, the LANDMACO Machine produces 600 pieces per hour. On some smaller threaded parts made from brass the 3/8" High Speed Machine has produced as high as 60,000 pieces per grind of the chasers.

Such performance assures lowest possible threading costs. It warrants your investigation in handling your threading operations.

Write for Bulletin No. H-91

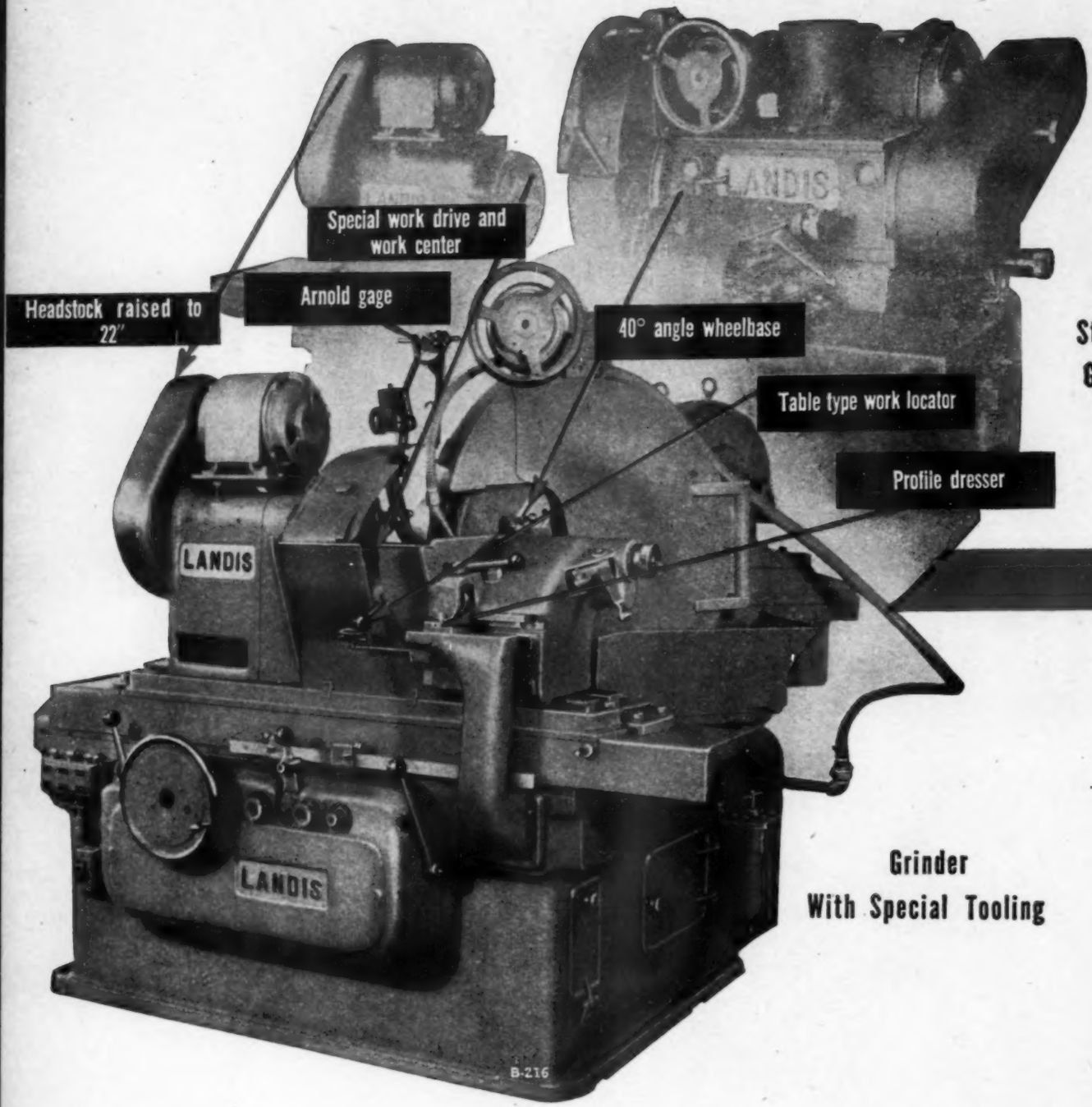
LANDIS

MACHINE CO. WAYNESBORO PENNA. U.S.A.



The ⅜" Threading Machine and the LANDMACO Threading Machine are equipped with the LANCO Head which employs the LANDIS Long Life Tangential Chaser.

7 Steering Knuckle Diameters Ground on *One* Machine with 3 Setups



Standard Grinder

Grinder With Special Tooling

LANDIS TOOL *Precision Grinders*

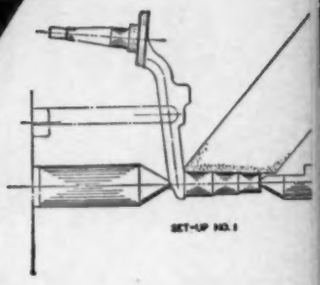
Your grinding problem may be simpler or far more complex than this one. With Landis Tool Engineered Grinding Service you will get a similar low cost solution. Write us details for a recommendation. 59

LANDIS TOOL COMPANY, WAYNESBORO, PA.

How a Tough Grinding Job was Solved with Special Tooling

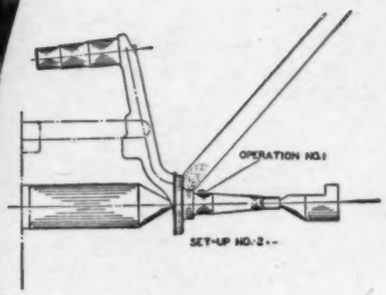
Setup #1

To grind 26.613—28.710—31.455 m.m. diameters. Profile truing fixture, operated by the power traverse. 4" face wheel and wheel guard. Caliper frame for 31.455 diameter. Wheel 30" x 4" x 12".



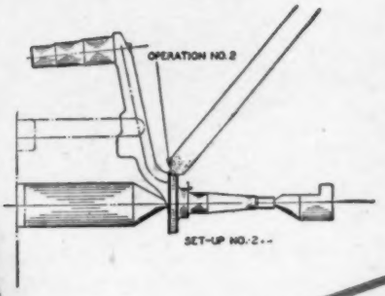
Setup #2
Operation 1

To grind 36 m.m. diameter Right angle wheel truing fixture. 1" face wheel and wheel guard. Caliper frame for 36 and 72 m.m. diameters. Wheel 30" x 1" x 12".



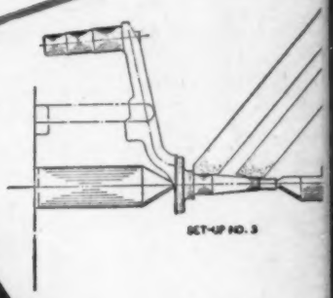
Setup #2
Operation 2

To grind 72 m.m. diameter. Right angle wheel truing fixture. 1" face wheel and wheel guard. Caliper frame for 36 and 72 m.m. diameters. Wheel 30" x 1" x 12".



Setup #3

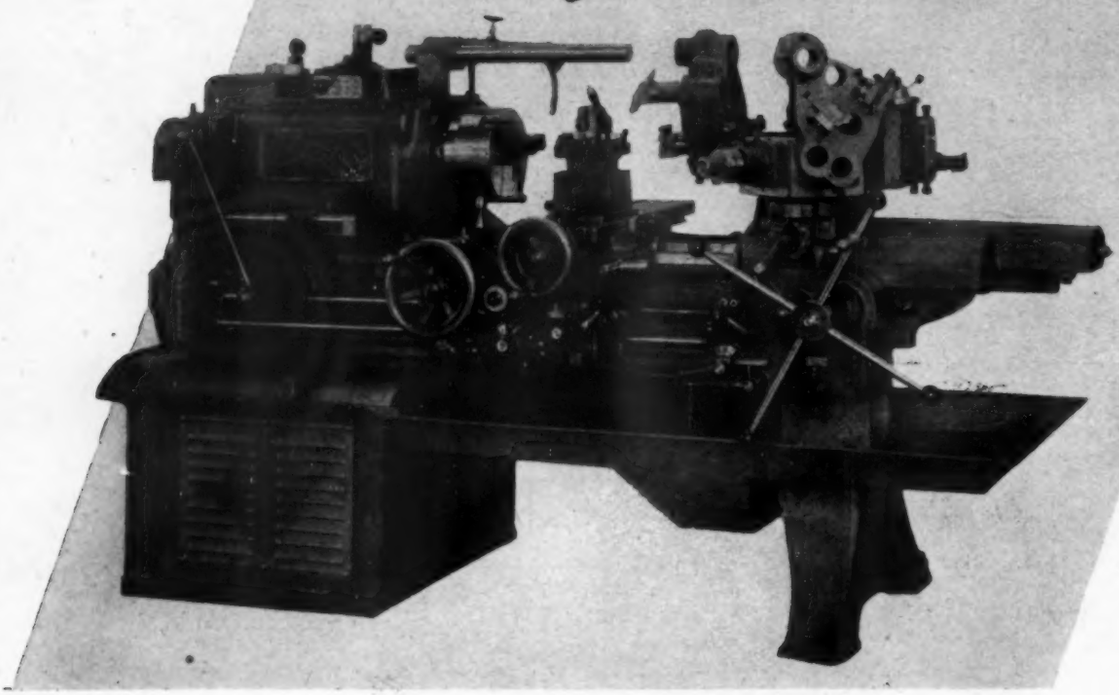
To grind 15.870 m.m. diameter—25.400 m.m. diameter. Double wheel center. Profile bar for wheel truing fixture. Wheel 27¼" x 1¼" x 12".



LODGE and SHIPLEY features

SIMPLICITY OF CONTROL

EASE OF OPERATION



● Lodge and Shipley ACME Universal Turret Lathes have the power and rigidity to stand up over long periods on tough jobs requiring carbide cutting tools—yet Lodge and Shipley ACME simplicity of control and ease of operation enable new operators to become expert on these machines very quickly. They have wide feed and speed ranges and are meeting a great variety of production demands quickly, accurately, economically.

Note these advantages:
Hardened and ground vees mounted on wider centers. Triple roller bearing spindle. Carriage gibbed to both vees, also between carriage apron and lower front side of bed. Heavy, accurately machined main turret and saddle, equipped with powerful clamping mechanism, likewise offer maximum resistance to deflection of heavy, high-speed cutting.

We illustrate the Lodge and Shipley ACME No. 6W (Way Type). Many other types and sizes available. Write for literature.

THE WORLD OVER KNOWN FOR GOOD LATHES ONLY L&S LATHES

THE LODGE & SHIPLEY COMPANY

CINCINNATI 25, OHIO, U. S. A.

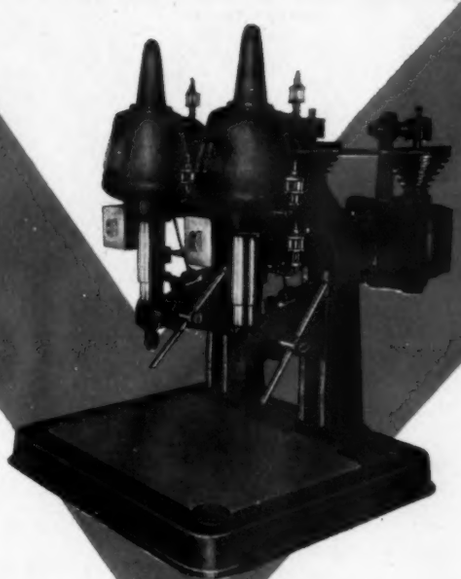
MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

Built Right!

Like an athlete, a CANEDY-OTTO Drill press is stripped for fast, precision performance — no gadgets, no superfluous and costly attachments. Our 53 years experience as specialists in drill press design assure you that each unit is BUILT RIGHT — an advanced design, quality built for low-cost, accurate, high speed production. Fill all your drill press requirements from the World's Most Complete Drill Press Line — the Canedy-Otto line.

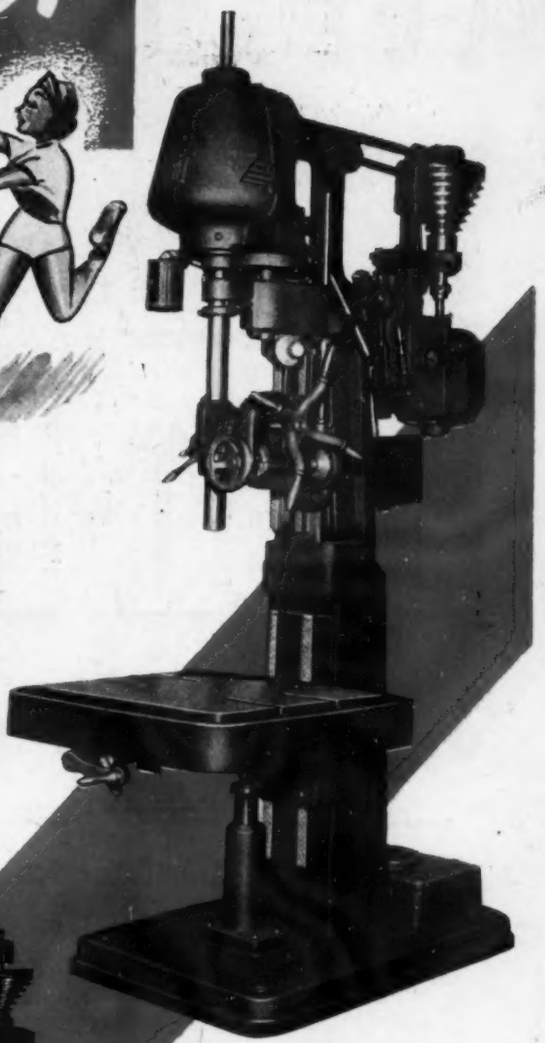
21" SLIDING HEAD FLOOR DRILL

1½" Capacity, 16-32 speed, single spindle model. Solid one-piece semi-steel cast frame with machined and integrally cast ways for movement of sliding head and table. Full floating spindle pulley. Spindle of heat-treated, high alloy steel, multi-splined. Available with Vee belt drive, back gear and power feed. Entire motor assembly mounted on famous C-O tilting bracket.



21" BOX COLUMN FLOOR DRILL

1½" capacity, available in one through six spindle models, of full ball and Timken roller bearing design. High alloy steel, heat treated spindle, with positive geared motor and automatic stop for predetermined depth drilling. Also operates through lever power feed or worm wheel feed. Eight step Vee belt drive on tilting motor bracket gives sixteen spindle speeds. Table, column and base of semi-steel casting, finished and normalized.



16" NO. 5-10,000 B.V. BENCH DRILL

A six speed, super-sensitive, high speed drill press available in 5/16"-3/8" capacity — floor or bench models — with one through six spindles. Ball bearing mounted, full floating spindle. Semi-steel cast column, frame, table and base. Motor unit mounted in famous C-O tilting bracket.

C THE WORLD OVER O

CANEDY-OTTO MFG. CO.

CHICAGO HEIGHTS, ILL.

Canedy-Otto Mfg. Company
Chicago Heights, Illinois

Please send illustrated catalog (Insert No. 90).

NAME .....

FIRM .....

ADDRESS .....

What's Your Drill-Bill

ON JOBS LIKE THESE?

...drilling Magnesium, Brass and other Non-Ferrous Metals
...Plastics, Slate, etc.

HERE ARE SPECIAL-PURPOSE MORSE TWIST DRILLS TO CUT YOUR JOB-TIME AND YOUR COSTS

WHEN it comes to drilling Brass, die-cast metals and other non-ferrous metals or plastics and slate, Morse special-purpose drills *prove their worth.* They give faster production and last longer.

For like *all* Morse cutting tools . . . Morse drills, standard or special, are designed to do specific jobs better. They are made to exact specifications . . . length, diameter and twist-cut . . . to perform best when used for their specific applications, under proper conditions.

So no matter what your drill problems, look to *Morse* for the drill that will give you maximum performance at lowest drill-cost. Remember too, that Morse Engineering — backed by over 80 years of drill making and drill-use experience — can help you increase production and make *substantial* savings. Your Industrial Supply Distributor will cooperate in securing a Morse specification.

Morse Bakelite Drills (1361)
... for bakelite, ebonite, asbestos, fibre, brass, hard rubber, various molded plastics. Withstands strong abrasive action.

Morse Quick-Twist Drills (1363)
... High-speed steel for deep-hole drilling in aluminum, magnesium, die-cast metals; for slate and certain plastics. Especially suited for use in screw machine work.

Morse Brass Drills (1344)
... specially designed for brass work. Made with wide flutes to clear chips easily. Slow helix angle prevents drill from hogging into material.

Morse Cotter-Pin Drills (1386)
... for copper, brass castings, aluminum and magnesium. Especially good for skin metal drilling of non-ferrous metals used in aircraft and other types of manufacturing. Also used in portable electric drills.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

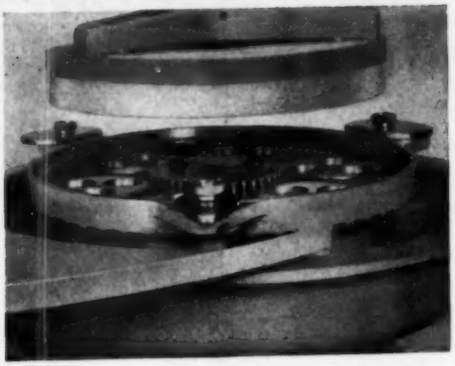
MORSE TWIST DRILL & MACHINE COMPANY

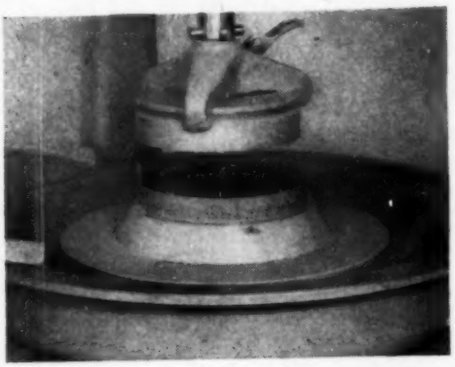
The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

Are You Precision Lapping?





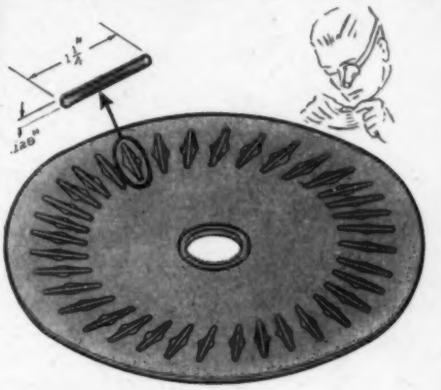
The NORTON 10U Flat and Cylindrical Lapping Machine is suitable for many purposes in the tool room and on the production line. The machine is well proportioned and uses a principle of moving the work in an ever changing pattern between two annular laps. Investigate the possibilities of this machine for lapping parts in your production. Write for bulletin #1482.

NORTON COMPANY, WORCESTER 6, MASS.

The NORTON 10-U is SPEEDY and VERSATILE

Non-metallic products such as ceramics and plastics offer an important field for lapping. For example, celluloid cubes are lapped to amazingly close accuracies using two-piece sprocket type workholder with adapters as shown and moving the work between bonded abrasive laps.

For small parts, such as might be used in the watch industry, the 10U Lapper is arranged with 8″ diameter laps instead of the conventional 14 or 16″ size. Here again parts are often lapped to sizes within .000025″ for accuracy. For this particular part, a watch plug gage, a plate-type workholder is used with cast iron laps.



The success of the Diesel engine is due in great measure to the efficiency of the fuel injector unit. Plungers, bushings and needles are lapped to amazing accuracies to insure proper operation when "under fire". Cast iron laps are used and the work is carried in workholders made to order for the particular parts involved.

NORTON GRINDERS
Also Lappers

HERE'S HOW MODERN MECHANICS ATTACK PROBLEMS OF GRINDING HARD-TO-REACH LOCATIONS

• Sterling Stermounts are fully described in this attractive four-page folder. It gives prices and detailed description of every size and shape. Send for it!

WORKMEN smile when they use Sterling's Stermount Wheels and Shapes. Schedules are easy to meet when these efficient aids to production are speeding up grinding.

There is the correct grain, bond, shape, size and structure to make every Stermount you use applicable to the job at hand. A special feature is the detachable spindle which can be used over and over again with several shapes and sizes.

Stermounts do the job without undue pressure and retain their cutting qualities extra long. Their use in your department will speed up production and cut cost . . . a Sterling engineer will gladly tell you how easily it can be done.

• STERLING ABRASIVES •

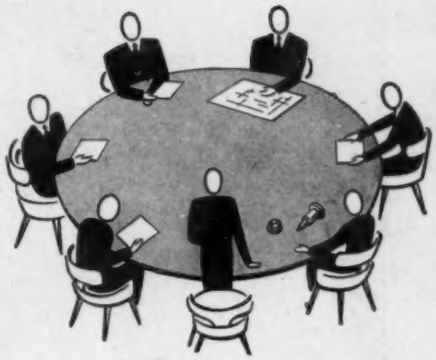
THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

there's a place for YOU at the

GISHOLT "ROUND TABLE"

Take your place here—whenever you seek new and better methods of producing round or semi-round parts! For this Gisholt "Round Table" symbolizes more than 50 years of collective experience in the manufacture and applications of metal-working equipment. And that experience—practical, authoritative—is yours to use in saving production time and cost.



your problem is carefully studied

Perhaps the solution is already waiting for you. If not, you may be sure that Gisholt's specialists will consider it as their own problem. Whether it involves large or small lot production, they will suggest the methods and equipment best suited to your individual needs.

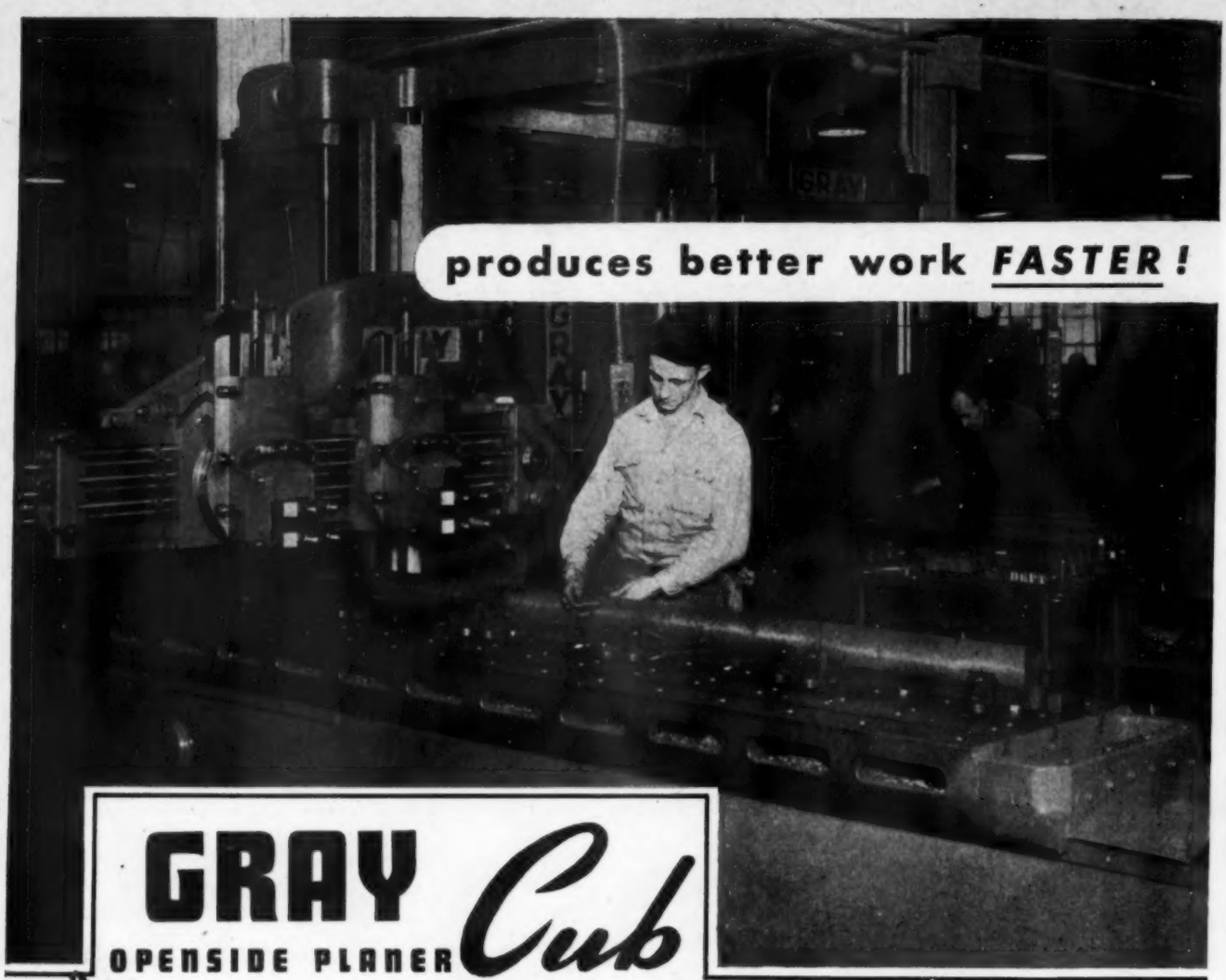
and the most practical solution is found in the broad Gisholt line

Here you may be sure of unbiased judgment, for Gisholt's interests and experience are not limited to one or two classes of machines. Here are length and breadth of experience in machining, surface-finishing and balancing round or semi-round parts that are best evidenced in the completeness of the Gisholt line itself.

GISHOLT MACHINE COMPANY

1245 E. Washington Ave., Madison 3, Wis.

THE GISHOLT ROUND TABLE *represents the collective experience of leading specialists in the machining, surface-finishing, and balancing of round and semi-round parts. We welcome your problems.*



produces better work *FASTER*!

GRAY *Cub* OPENSIDE PLANER

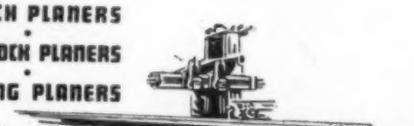
"A Bear for Production"

1. The planer for Carbide Tools—cutting and return speeds up to 300′ per minute.
2. Speed of cut and return instantly adjustable from operating position.
3. Table started in either direction, reversed, "inched", or stopped from pendant switch.
4. Single-Shift power rapid traverse controlled at the heads or from either end of rail.
5. Space Saver Drive, with Full Floating drive Shaft.
6. Non-Metallic Table Ways eliminate scoring.
7. Loop Lubrication. The only adequate system for high speed reciprocating tables.
8. Mechanical non-shock tool lifters.
9. Side head feed independent of rail heads.
10. Built in 24″, 30″ and 36″ sizes.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES

Write for fully illustrated descriptive Bulletin No. 55



The G.A. **GRAY** *Co.*

CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

Ralph C. Coxhead Corp. of New York has a new Vari-Typer that uses 600 styles and sizes of type, plus foreign language, chemical, mathematical and other symbols.

get ready with CONE for tomorrow

Patent 2,409,181 covers a sectional motor truck that can be separated into three pieces and carried anywhere by air.

be ready with CONE for today

Stromberg-Carlson has a new inexpensive adaptor that will enable most owners of pre-war FM sets to receive broadcasts on the new band.

get ready with CONE for tomorrow

Frigidaire, Division of General Motors, is making a plastic lid for its ice cream cabinets that is claimed to be 50% lighter than steel.

be ready with CONE for today

New England Carbide Tool Co. is taking tungsten carbide to the housewife in its new precision knife sharpener.

get ready with CONE for tomorrow

The State of Minnesota will go into business with Continental Machines, Inc. to engage in a continuous chemical process for the extraction of pure iron from slate formerly wasted at the Mesabi iron range.

be ready with CONE for today

The New Holland Machine Co. of New Holland, Pa., will test its new flame cultivator on truck and garden crops in the Rio Grande Valley this winter.

get ready with CONE for tomorrow

Bell System's first experimental rural radio-telephone circuit connects 8 Colorado farms with the Cheyenne Wells central office. Wind driven generators supply power.

The four largest alternating current motors ever built, 65,000 horsepower each, will be made by Westinghouse for Grand Coulee.

be ready with CONE for today

Lockheed's Little Dipper light plane is reported to cruise at 100 m.p.h. and land at 20.

get ready with CONE for tomorrow

A mobile alcohol plant built into a five car train that could travel from farm to farm was demonstrated at the National Chemical Exposition.

be ready with CONE for today

Phthalic anhydricle, one of the most important ingredients in the manufacture of paints, is now being made from petroleum by Oronite Chemical Company.

Climax Molybdenum Corp. is working on two new high temperature alloys. One has 60% chromium, 25% molybdenum and 15% iron. The other has 60% chromium, 15% molybdenum and 25% iron.

get ready with CONE for tomorrow

The Gyro-Glider developed at the General Electric Flight Test Center has a rotor instead of wings and weighs 120 pounds, ready to fly.

be ready with CONE for today

M. W. Kellogg Co. has a new process for separating a considerable number of useful substances from fish and vegetable oils using liquefied propane at high pressure.

get ready with CONE for tomorrow

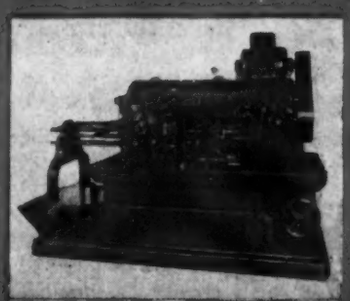
The Texas Company's new cold weather aircraft fuel is claimed to start an engine and to permit switching to regular aircraft gasoline in two minutes, in spite of extremely low temperatures.

FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

MORE facility is MORE value

The ⅛" 4-Spindle Conomatic, ordinarily assigned to rugged jobs, produced the brass pieces shown in 6 seconds each, including tapping.

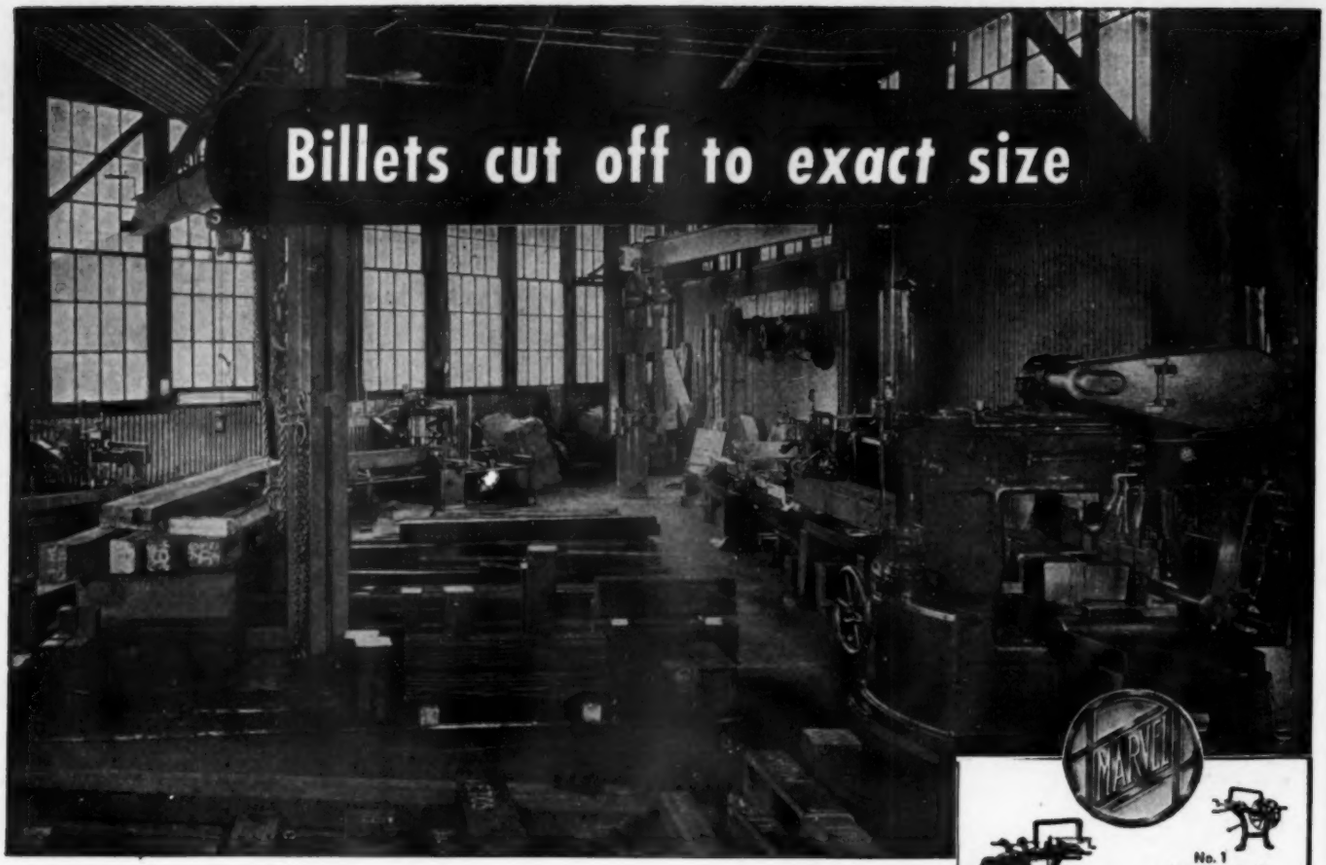
Ask your CONE *representative to show you our new color motion picture*



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

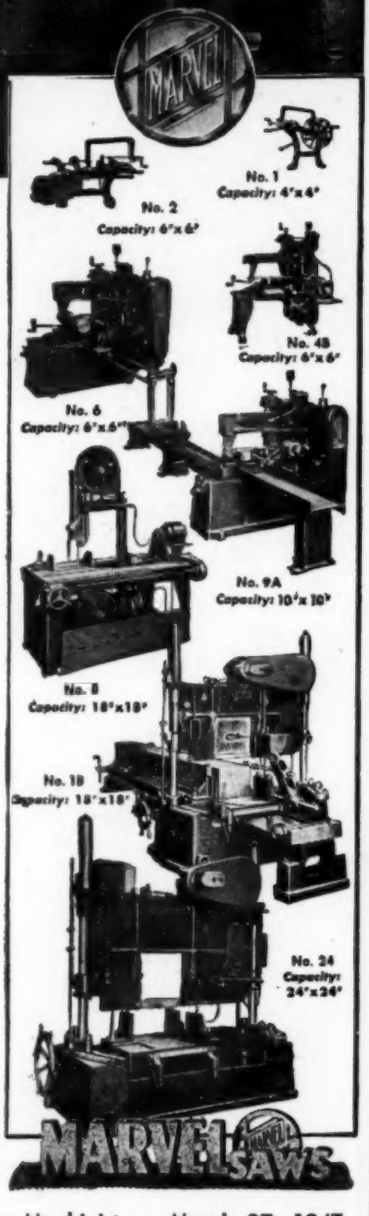
38



ANY QUANTITY CUT-OFF AUTOMATICALLY

These MARVEL Saws are money makers for this modern forge shop in many ways. (1st) they cut off billets for a small fraction of the cost of cutting-off with a hammer. (2nd) these billets are so accurate in size that they exactly fill the dies with no excess fin, not only simplifying trimming and finishing, but getting extra billets from many bars. (3rd) they keep all hammers busy on *production* work for these "world's fastest" saws can keep ahead of any schedule. (4th) they reduce cutting-off labor costs to an absolute minimum. It takes only one operator and a helper to keep all of these saws running because all but the No. 18 Giant Hydraulic Saw (at the right) are *automatic*—feed measure, and cut-off identical billets; requiring no more attention than automatic screw machines.

Your local MARVEL Sawing Engineer will gladly call and explain how you can add these five extra profits to your forge operation.



ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE **CHICAGO 39, U.S.A.**

Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.

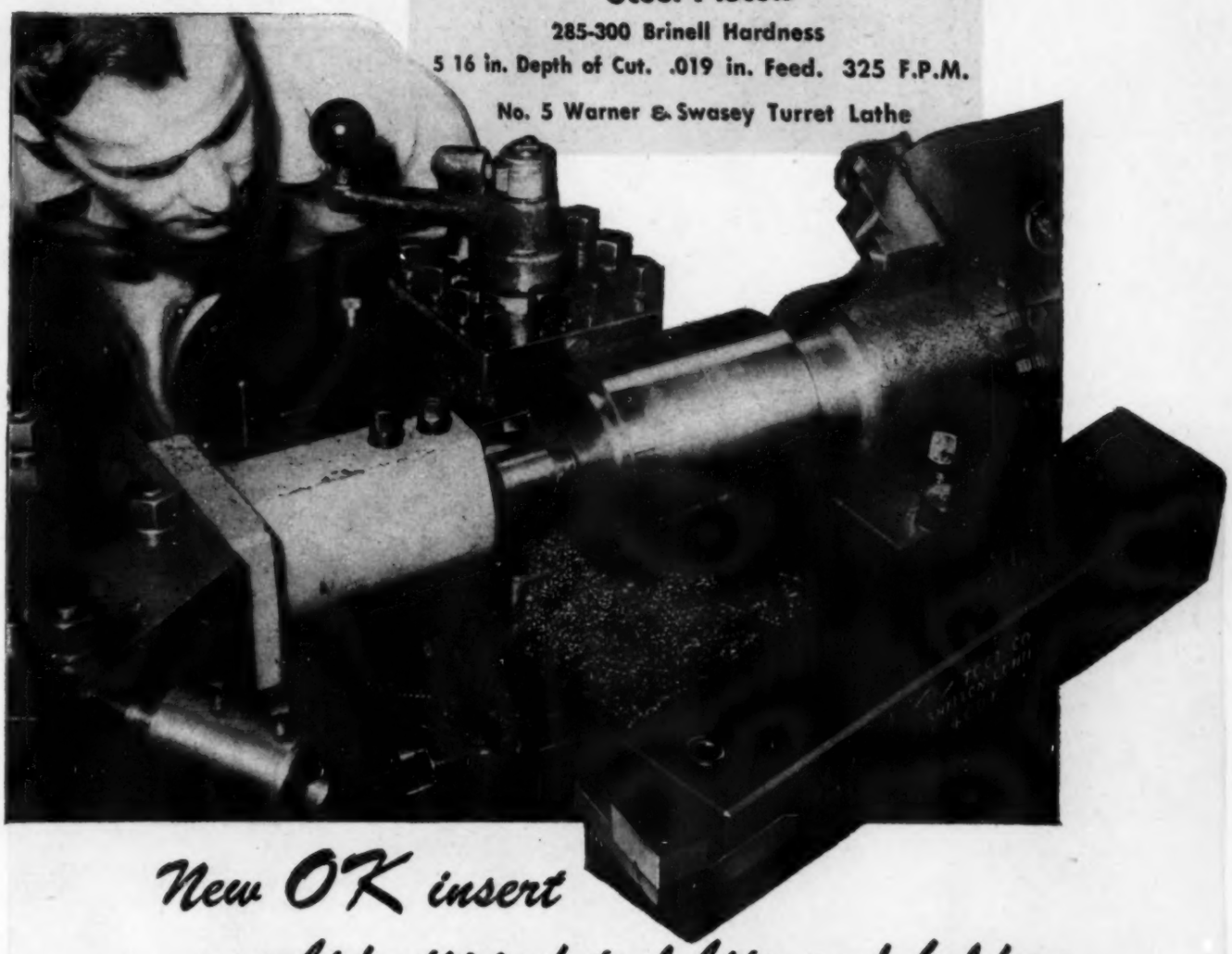
MARVEL SAWS

OK CARBIDE TIPPED TOOL
Machining Maxel Forged Steel Piston

285-300 Brinell Hardness

5 16 in. Depth of Cut. .019 in. Feed. 325 F.P.M.

No. 5 Warner & Swasey Turret Lathe



New OK insert carbide tipped tool bits and holders

GIVE AN Amazing PERFORMANCE

IT IS 12 o'clock noon when we are ready to shoot this picture at the New Haven Vibrator Company. Instead of grabbing lunch, the boys (old timers and recently returned GI's) watched the show with wide-eyed amazement. Never before had this shop seen so much metal removed in so little time. An insert with a carbide tip the size of your thumb nail zipped a cut 5/16 in. deep at the rate of 325 feet per minute. The work piece is a Maxel forged steel piston, 285-300 Brinell hardness, for a foundry vibrating machine. It is finished with a very fine smooth surface and each piece is machined in about one-sixth the customary time.

These new OK Carbide Tipped Tool Bits and Holders have the famous OK locking principle. Mated serrations provide for advancement to compensate for wear and furnish solid support to prevent vibration.

LOW COST. Every shop now can increase the earning power of lathes, etc. and gain the advantages of the super speed of OK tools. These Holders, Series 400, come ⅝, ¾, 1, 1¼ and 1½ inches square and in standard lengths. Interchangeable insert tool bits with carbide tips come ready for immediate use for Turning, Boring, and Facing, and for right and left hand for machining every material. The Holder illustrated is 1¼ inches square, price $3.94. In quantities of fifty, tool bits are priced as low as $3.45.

Send today for one of these 400 Series tools bits and holders. We require the following information: Characteristics of the material to be machined; make and model of machine; size of holder machine will take; horse power available; the operation (turning, boring, or facing) and right- or left-hand.

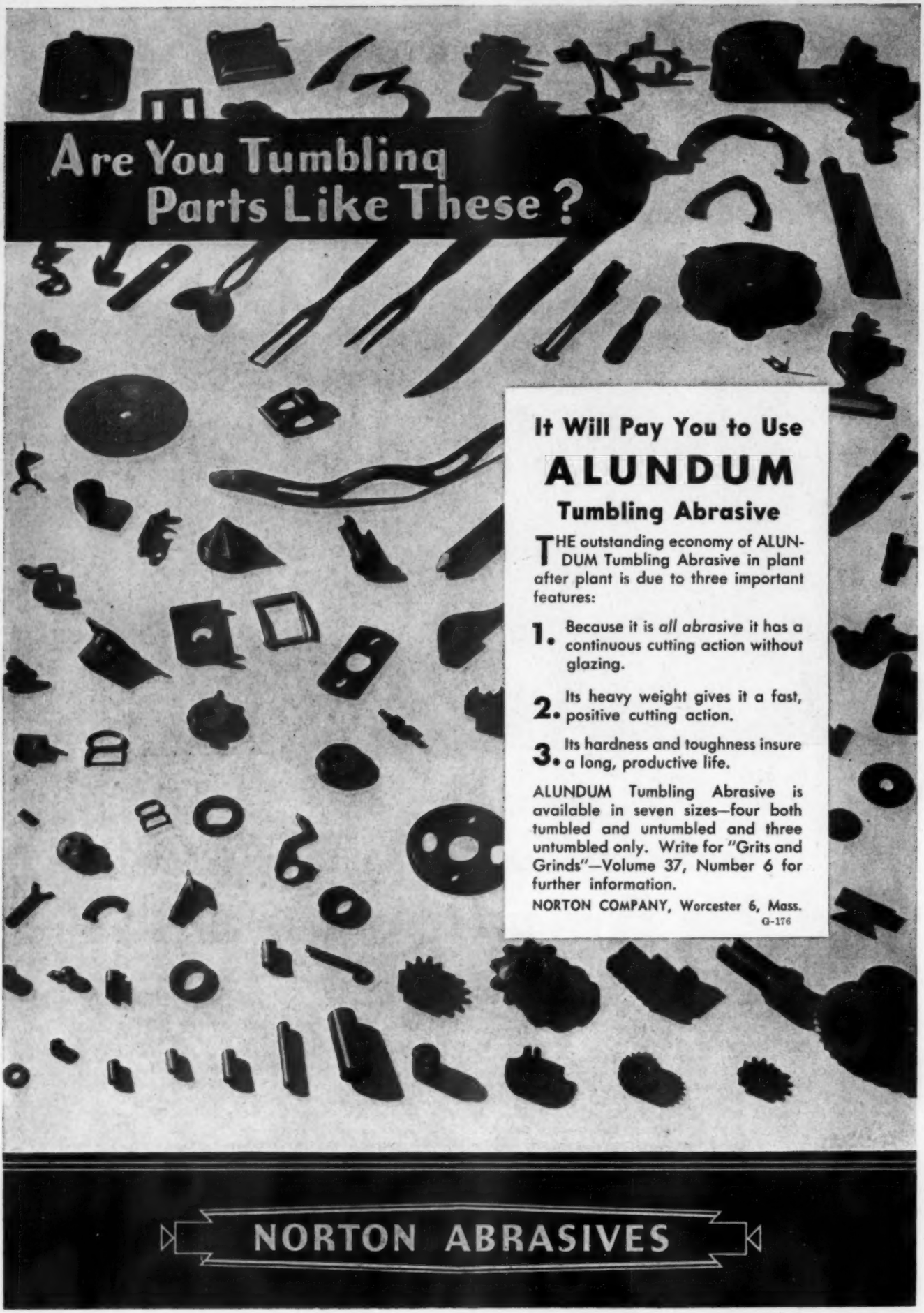
An OK Tool Field Engineer will be glad to demonstrate the features of these new tools on your own machines.

THE OK TOOL COMPANY, INC. **26 Hull Street, Shelton, Conn.**

AMERICA'S NUMBER ONE INSERTED BLADE

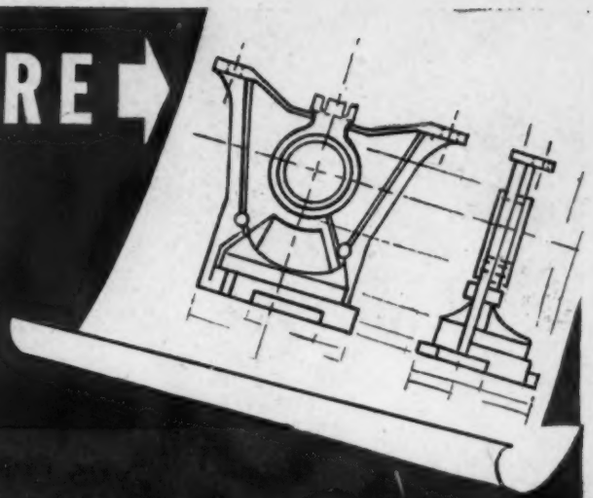
Milling Cutters . . . Boring Tools . . . End Mills

SINCE 1901


Are You Tumbling
Parts Like These?
It Will Pay You to Use
ALUNDUM
Tumbling Abrasive
THE outstanding economy of ALUNDUM Tumbling Abrasive in plant after plant is due to three important features:
1. Because it is *all abrasive* it has a continuous cutting action without glazing.
2. Its heavy weight gives it a fast, positive cutting action.
3. Its hardness and toughness insure a long, productive life.
ALUNDUM Tumbling Abrasive is available in seven sizes—four both tumbled and untumbled and three untumbled only. Write for "Grits and Grinds"—Volume 37, Number 6 for further information.
NORTON COMPANY, Worcester 6, Mass.
G-176
NORTON ABRASIVES

The help we give you HERE will save you money

HERE



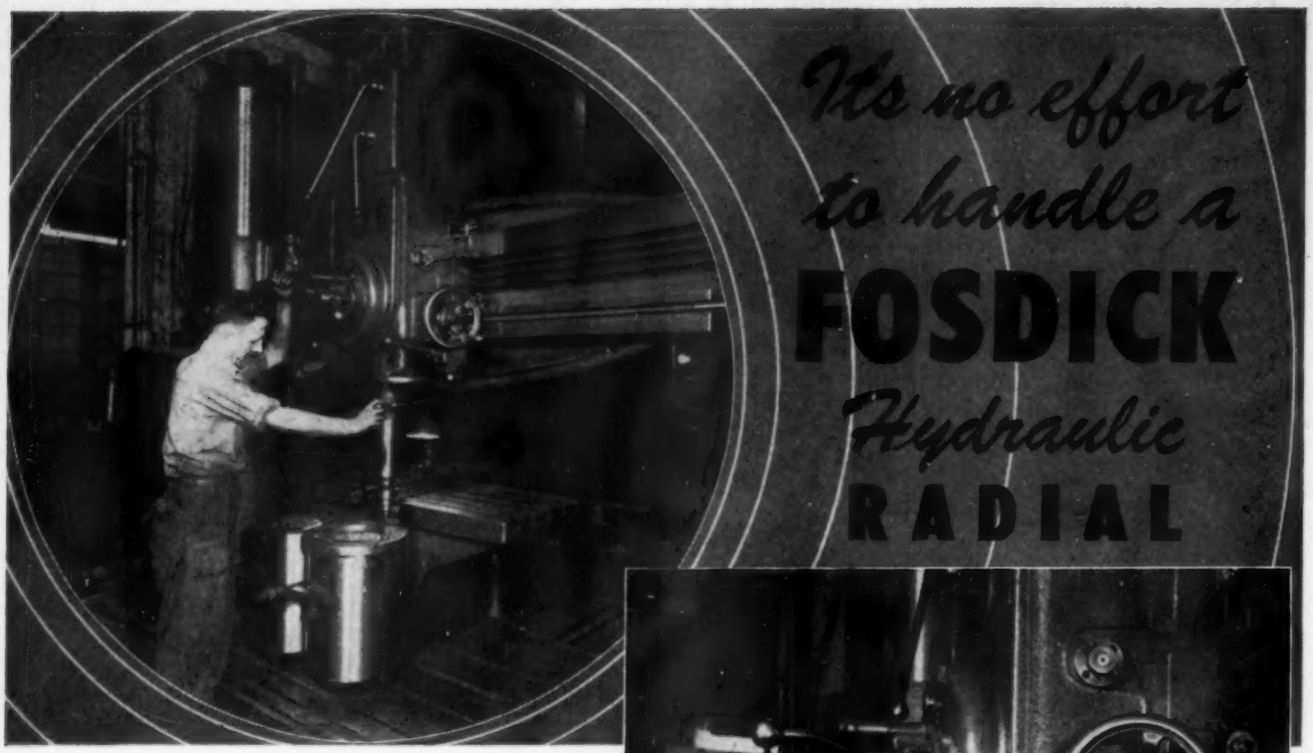
While the designs for aluminum die castings you'll need months from now are still sketches on the drawing board . . . *this* is the time to call in the Alcoa die castings experts. They can help you get all the benefits of strength and light weight from aluminum die castings. They can show you how to simplify designs to reduce costs of parts.

Our engineers will be glad to discuss your die castings problems with you. Write to ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in leading cities.

MORE people . . . want MORE aluminum . . . for MORE uses than ever

ALCOA FIRST IN ALUMINUM

IN EVERY COMMERCIAL FORM



It's no effort to handle a FOSDICK Hydraulic RADIAL

● The ease with which operator can handle all controls from his normal working position results in maximum production of a wide variety of jobs.

On the installation shown two pieces are set up simultaneously and a template is used to locate holes accurately on each piece.

This is only one of hundreds of jobs that can be handled on a Fosdick Radial—easily—quickly—at low cost.

The hydraulic variable rapid traverse to the head—hydraulic column clamp—and hydraulic arm clamp, interlocked with hydraulic raising and lowering of the arm are features which facilitate operation and save operators time.

If you have work which can be handled on a Radial it will pay you to investigate the many time and labor saving features of the Fosdick hydraulic radial.

Complete details of construction fully illustrated and described in Fosdick Radial Bulletin —R.A. Write for your copy today.

THE Fosdick MACHINE TOOL COMPANY
CINCINNATI 23, OHIO

IT'S EASY TO FIND "FAULTS" WITH THESE INSTRUMENTS!

It's easy to check for the faults in your products with these and other handy G-E testing and measuring instruments. Let them help you. Save time. Save money. Avoid needless waste by keeping an "eagle eye" on the items of your production line. As an added use, make them serve as checks on permanent equipment. Avoid unnecessary breakdowns.

Our engineers will be glad to help you with any particular testing or measuring problems you may have. Just call our nearest office, or write the *Special Products Division, Apparatus Dept., General Electric Co., Schenectady, N. Y.*

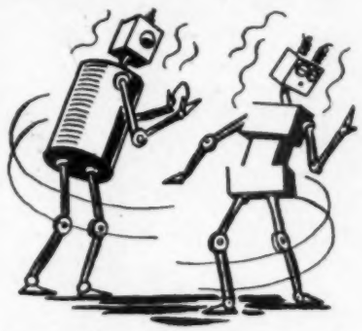
IS YOUR WELDING-MACHINE UP TO PAR?

For checking the performance of resistance welding and for studies in welding research here's a convenient device: the G-E *current-force recorder.* Compact and portable, this equipment records simultaneously a timing wave, the rapidly changing electrode force, and the electrode current of a resistance-welding machine while a weld is being made. It can also be used as a general-purpose amplifier and oscillograph with other types of electric gages for measuring strain, pressure, and other values. For further details, write for Bulletin GEA-4450A.

KNOW YOUR INSULATION FACTS!

To detect insulation faults quickly and easily, enlist the services of a G-E *insulation-resistance meter.* Use it to measure uniformity of insulating materials during the manufacturing process—or on apparatus already installed to indicate the condition of the insulation so that preventive maintenance can be performed promptly. Small, compact, portable. Insulation resistance over a range of 0 to 20,000 megohms can be measured. With this device studies of the effect of temperature and humidity on insulation can also be made. For further information, write for Bulletin GEA-4174.

STOP THOSE MACHINE JITTERS!



Your machinery can have fewer fatigue failures after a check-up with G-E *vibration equipment.* By measuring displacement and velocity of vibration, these instruments will help you to (1) improve product quality, (2) reduce damage to machinery and buildings, and (3) reduce noise. You'll find them accurate and easy to use. Write for Bulletin GEA-4140.

CAN YOUR SHIPPING PACKAGE "TAKE IT"?

Find out with the G-E *puncture tester!* This valuable device provides an accurate measure of the resistance of shipping containers to both puncture and bending. Corrugated board, fibreboard, wall board, thin plywood, heavy paper or liner, vulcanized fibre can all be measured for strength. For full details, send for Bulletin GEA-4168.

HERE'S $100 OF "KNOW HOW"

●Teach the elements of electronics this convenient way . . . with the G-E 12-part talking slide film. A splendid aid in training new technical personnel, in "refreshing" supervisory and production men, and even for teaching non-technical personnel. It comes complete with 12 slide films and records, 300 review books, instructor's manual and carrying case; price of the kit is $100. Call your local G-E office, or order direct from *Apparatus Dept., Section 800-32, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

General Electric Co., Section E800-32
Schenectady 5, N. Y.

Please send me the bulletins checked below:

GEA-4450A—Current-force recorder
GEA-4174—Insulation-resistance meter
GEA-4140—Vibration equipment
GEA-4168—Puncture tester

Name.....

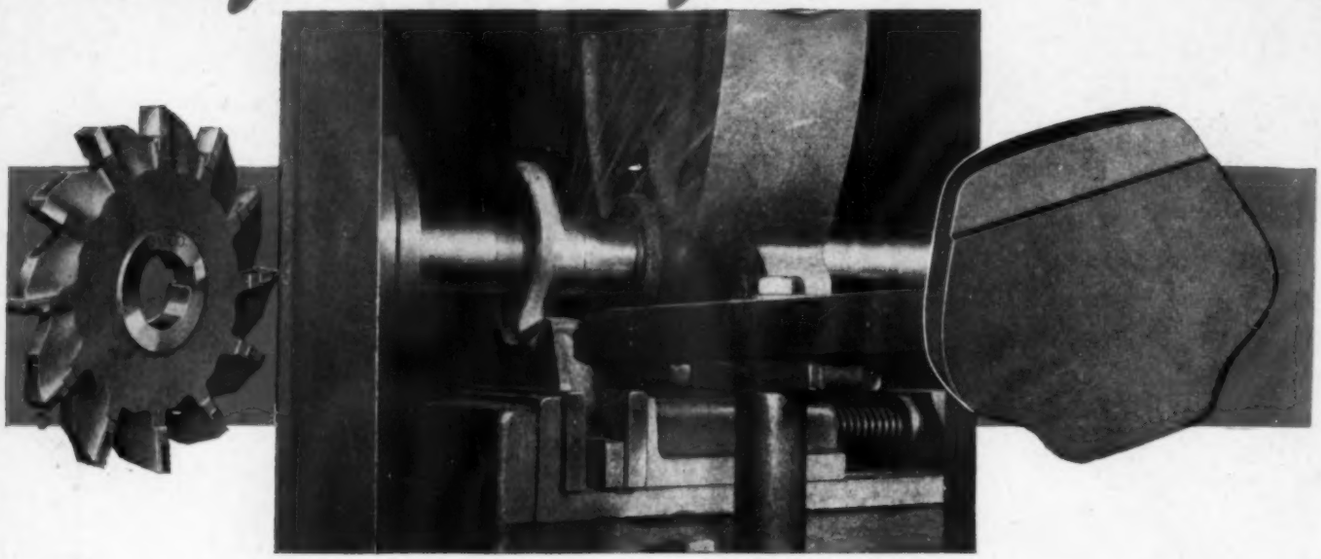
Company.....

Address.....

City.....**State**.....

8861

Speed Operations



WITH B-C CARBIDE TIPPED SIDE MILLS

TOOL LIFE INCREASED 8 TO 1
PRODUCTION 4½ TO 1

Before this manufacturer investigated the possibilities of using B-C Carbide Tipped Side Mills, previous feed used was 1⅜" per minute and surface speed 70 feet per minute. Production averaged 100 pieces per ten hour shift, and tool life 100 pieces per cutter sharpening. Castings had to be very clean in order to get this tool life with high speed steel cutters.

Now, with B-C Carbide Tipped Side Milling Cutters, the feed has been increased to 11" per minute and the speed to 375 surface feet, resulting in a production of 45 pieces per hour and tool life of 800 pieces per grind. A much better finish is reported and size is held more accurately

If you desire to speed up cutting time and increase production on your milling jobs, with further improvement in product quality, Barber-Colman Cutter Engineers will be glad to recommend the proper carbide cutters. Send your part prints for quotation.

TROUBLE SHOOTING? Tool Supervisors:— Production Superintendents:— If you are having difficulty smoothing out certain milling operations, get a copy of MILLING CUTTER DATA Description of actual field installations using B-C Milling Cutters will suggest comparable feeds, speeds and tooling arrangements for your work. A note on your company letterhead will bring you a copy promptly

MODERN MACHINES WITH ORDINARY BARBER B-C COLMAN CUTTING TOOLS ARE NOT FULLY EFFICIENT

CUTTER PERFORMANCE FACTS

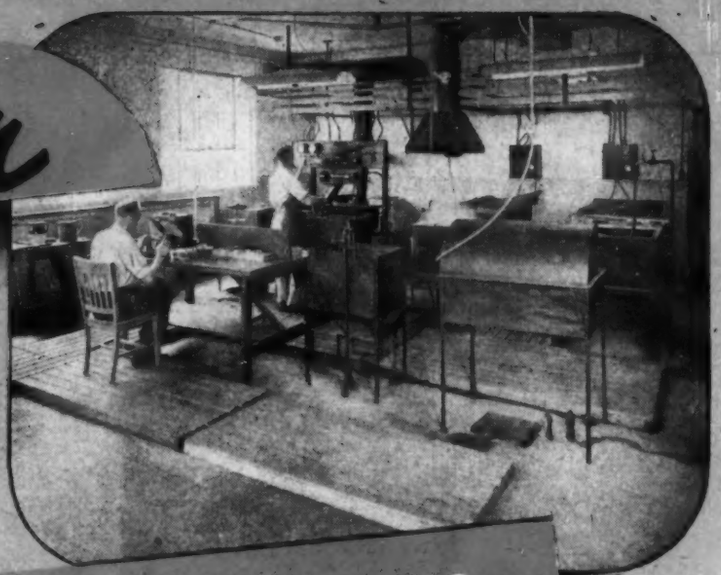
Operation — Milling slot ½" wide and 1" deep from solid metal
Material — Medium cast-iron
Cutters — B-C Carbide Tipped Side Mills, 4"x ½"x 1¼"

	Former	*Present*
Feed	1⅜" per min.	11" per min
Speed	70 S.F.M	375 S F.M
Floor-to-Floor	10 per hour	45 per hour
Tool Life	100 pieces per sharpening	800 pieces per sharpening

Barber-Colman Company

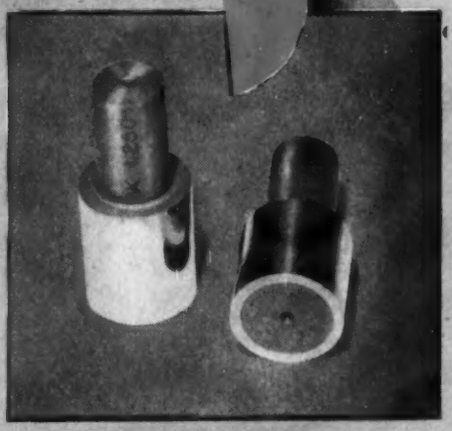
GENERAL OFFICES AND PLANT, 111 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

Van Keuren

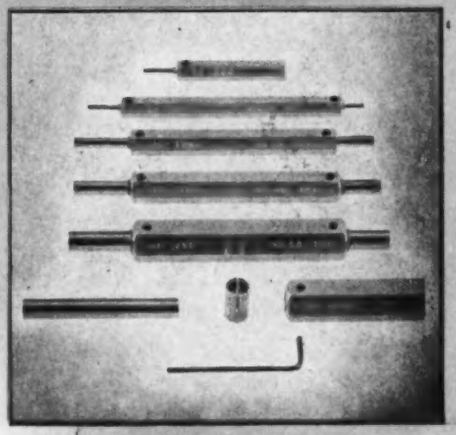


PRECISION CHROMIUM PLATING applied to Plug Gages

THE Van Keuren Co. has developed a new method of precision chromium plating of wire type and taper insert plug gages. In this modern plant we have combined the best available plating practice with the ability to make precision measurements. We are able to deposit a chromium wear surface accurate to a few millionths of an inch. Gages are finished to the low wear limit and then are plated to the high wear limit. The result is a thin, closely adhering wear surface which will not crack or peel and which is available at a very moderate cost.



Instead of paying 50 to 75% additional for chromium-plated gages, they are now available for only 25% additional and they wear 3 to 5 times as long as steel gages. The many repeat orders which we are getting from large users indicate that this new method is resulting in more prompt deliveries, greater wear, lower gage cost, and satisfied customers. For your next gaging job, specify Van Keuren chrome-plated gages.



Handbook and Catalog No. 33.

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

28TH YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.

HALLOWELL

Fig. 732
Drawer is extra.
Patd. & Pats. Pend.

MEMO

TO: Maintenance Managers, Shop Foremen, Purchasing Agents

FROM: Management

SUBJECT: "Hallowell" Shop Equipment of Steel

Be sure to order "Hallowell" Shop Equipment of Steel. We are convinced that this sturdily built, all-steel equipment is what we need. It has welded and hydraulically riveted joints — which means it will never wobble or fall apart. The "Hallowell" Work Benches of Steel come in five heights and seven lengths — and so they can be arranged to any length or height we need. The stools come in heights from 18" to 30" — this will provide the right height stool for each worker.

And don't forget the "Hallowell" Tool Stands of Steel — or the "Hallowell" Trucks of Steel with those free-rolling casters.

Make our shop the most modern, efficient and up-to-date shop in town, with "Hallowell" Shop Equipment of Steel.

"Unbrako" and "Hallowell" Products are sold entirely through distributors.

Fig. 1729

Fig. 1334

Fig. 1249

Fig. 2207

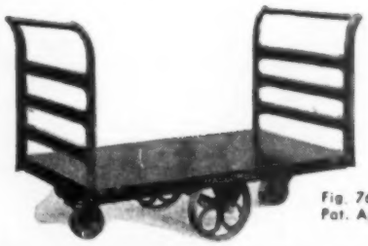


Fig. 769
Pat. Applied for.

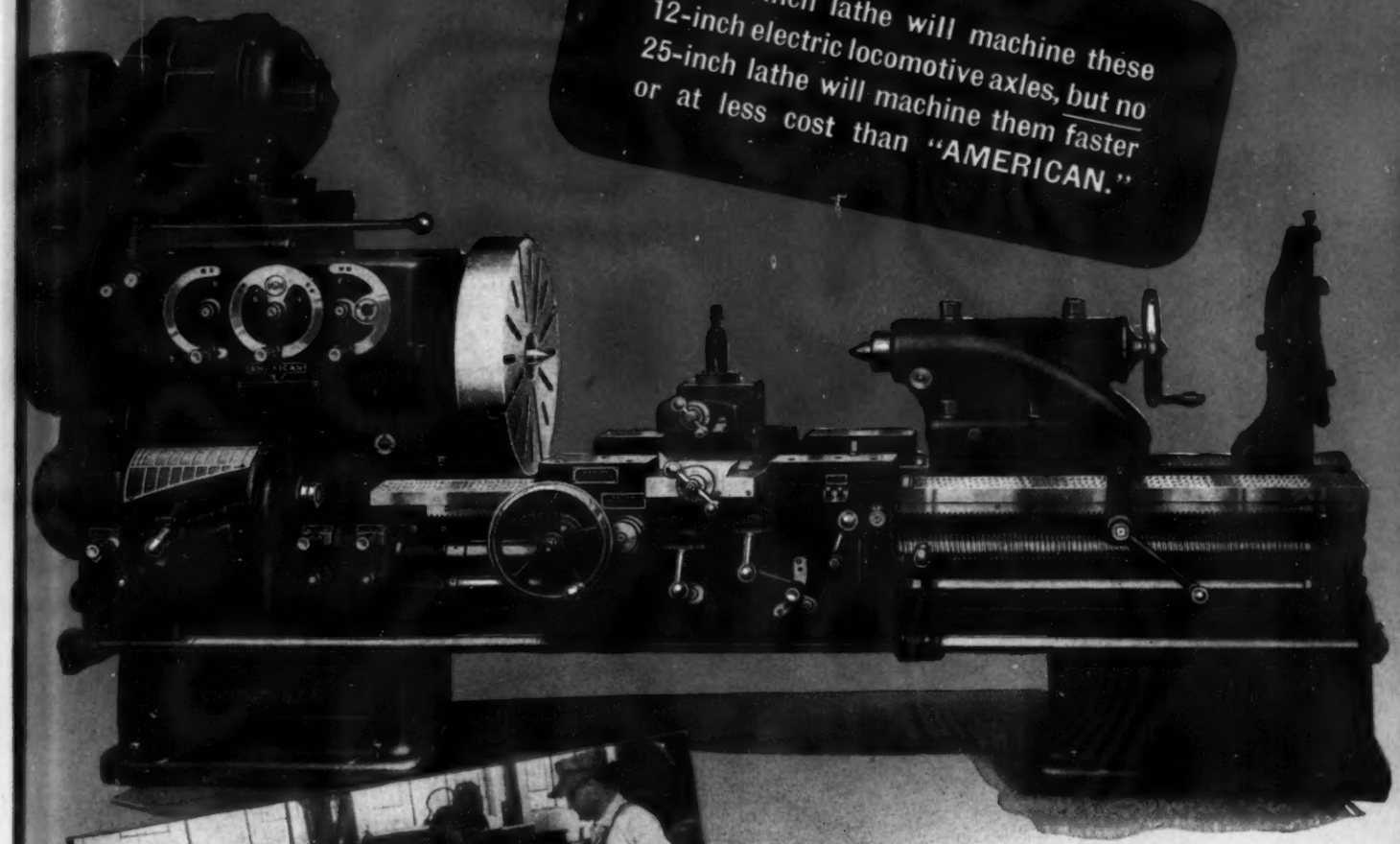
HALLOWELL

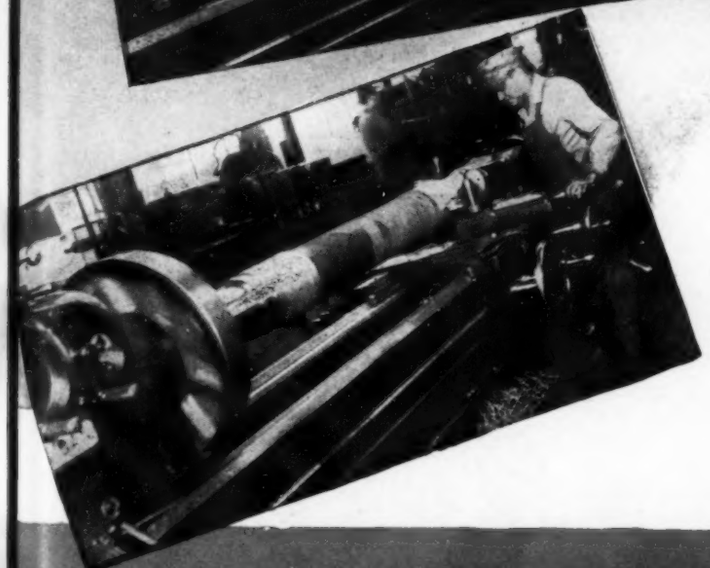
Over 44 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Any 25-inch lathe will machine these 12-inch electric locomotive axles, but no 25-inch lathe will machine them faster or at less cost than "AMERICAN."





The tremendous power of the 25-inch "American" High Duty Lathe permits the use of cemented carbide cutting tools at full capacity.

Many of these lathes are operating constantly to the limit of 30 horse power driving motors.

Their inherent stamina insures the heaviest cuts without vibration.

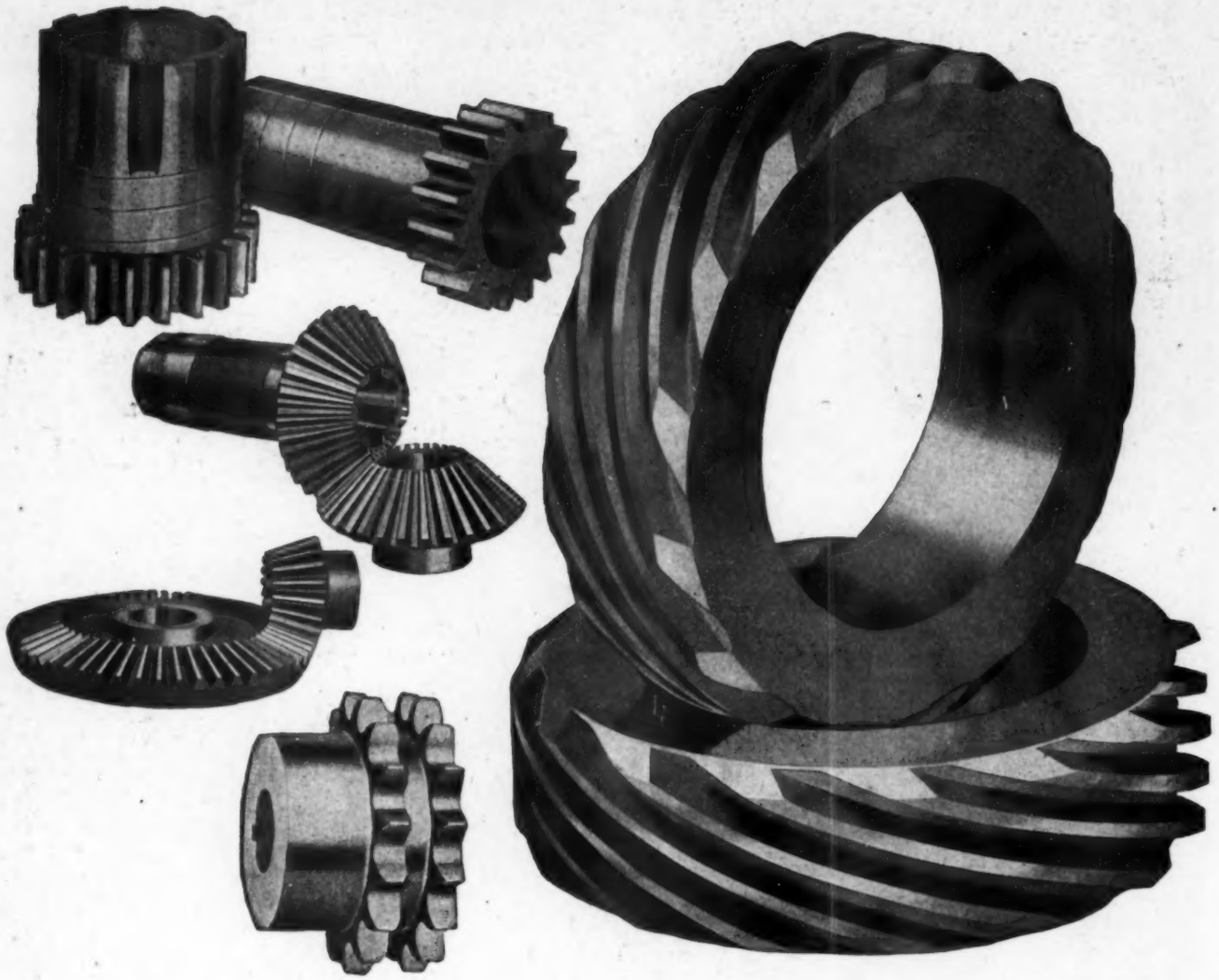
The thorough and careful processing of all transmission elements produces the fine finish required by this type of work.

"AMERICAN" LATHES IN YOUR SHOP MEAN HIGH QUALITY AT LOW COST.

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills



Specify Adams

for high quality gears made *EXACTLY* to your specifications

REGARDLESS of quantity or type, you'll profit by specifying Adams custom made gears for your product. Made on the most modern gear cutting machines by skilled workmen, Adams gears are quality controlled to guarantee exact conformance to your specifications. Write for further information, today. THE ADAMS COMPANY, 1942 Bridge St., Dubuque, Iowa.

the ADAMS company
Dubuque, Iowa, U. S. A.

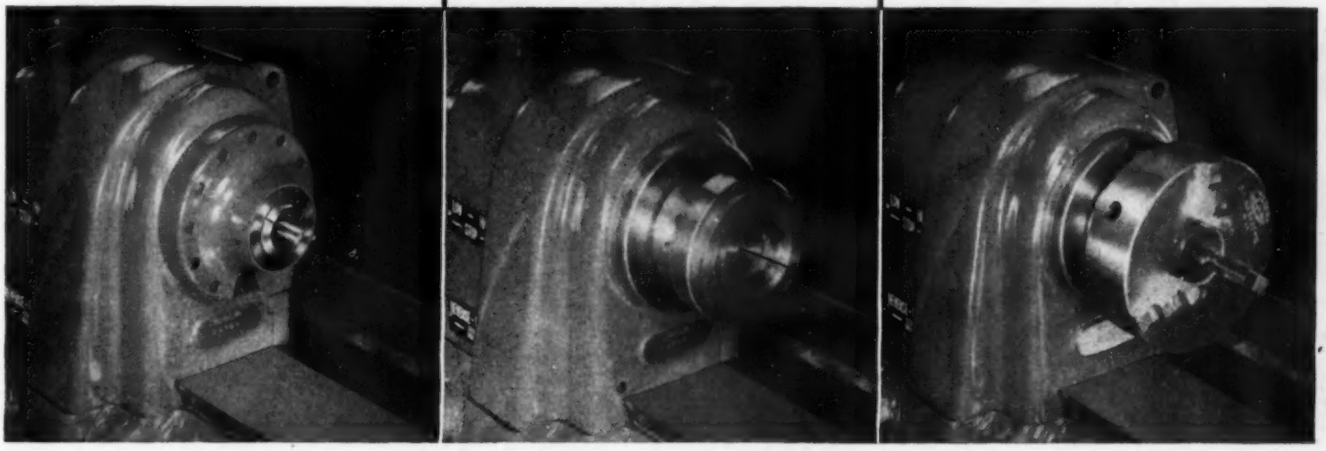
GEARS

FINE GEARS MADE TO YOUR SPECIFICATIONS . . . ESTABLISHED 1883

HARDINGE
ELMIRA, N.Y.

"Unusual capacity" describes
the HARDINGE High Speed Precision Second Operation Machine

1" COLLET CAPACITY | **6" STEP CHUCK CAPACITY** | **5" JAW CHUCK CAPACITY**

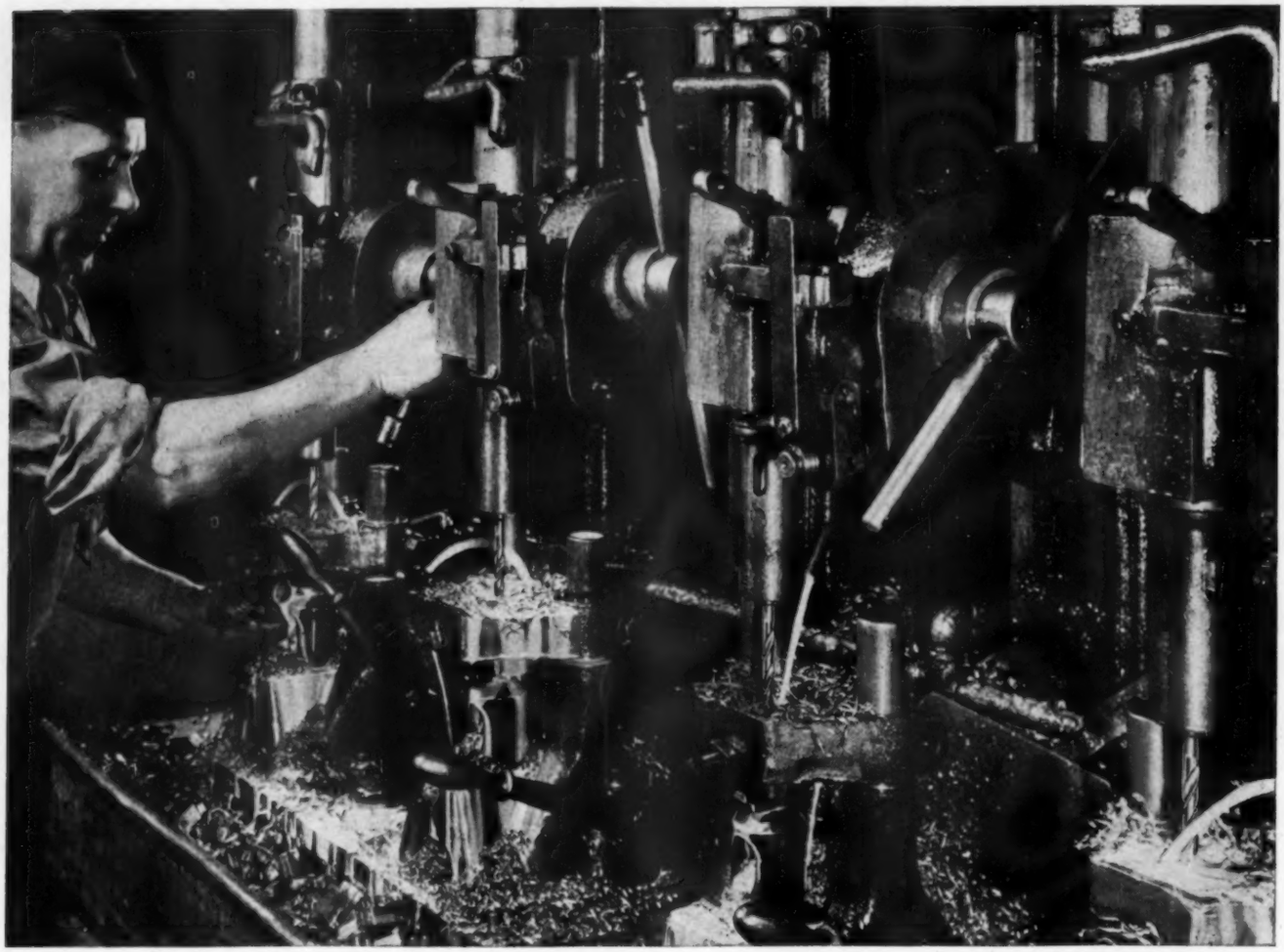


Write for Bulletin DSM 59 giving other features

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

HOW MANY *Holes Per Grind?*



CLE-FORGE HIGH SPEED DRILLS

TRADE MARK REG. U.S. PAT. OFF.

It isn't the *price* of a drill that determines its value to you. The number of *holes per grind,* or the cost per hole, is the factor that you should consider in selecting a drill.

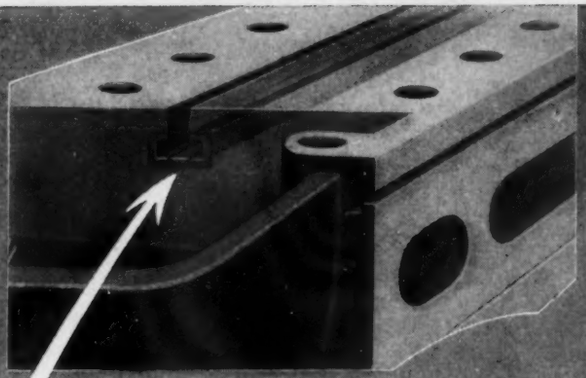
Hundreds of shops have tested CLE-FORGE High Speed Drills on this basis and have standardized on CLE-FORGE as a result of these tests. You too will find that CLE-FORGE High Speed Drills produce holes faster and at lower cost.

Telephone your I S D INDUSTRIAL SUPPLY DISTRIBUTOR

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND 14

TRADE MARK REG. U.S. PAT. OFF. AND FOREIGN COUNTRIES

70 THOMAS ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 6 • 459 HOWARD ST., SAN FRANCISCO 5
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 5
E. P. BARRUS, LTD., LONDON W 3, ENGLAND



Examine your old Planer Tables and then realize the advantages of the patented HYPRO Steel Tee Slot Inserts

- Prevents damage to tee slots by bolt heads
- Prevents pulling out of tee slots
- Insures perfect condition of table thruout life of machine
- Facilitates removal of chips as they will slide freely on the smooth steel not requiring a special tool to remove them
- Can be renewed if necessary

Here's where the wear begins

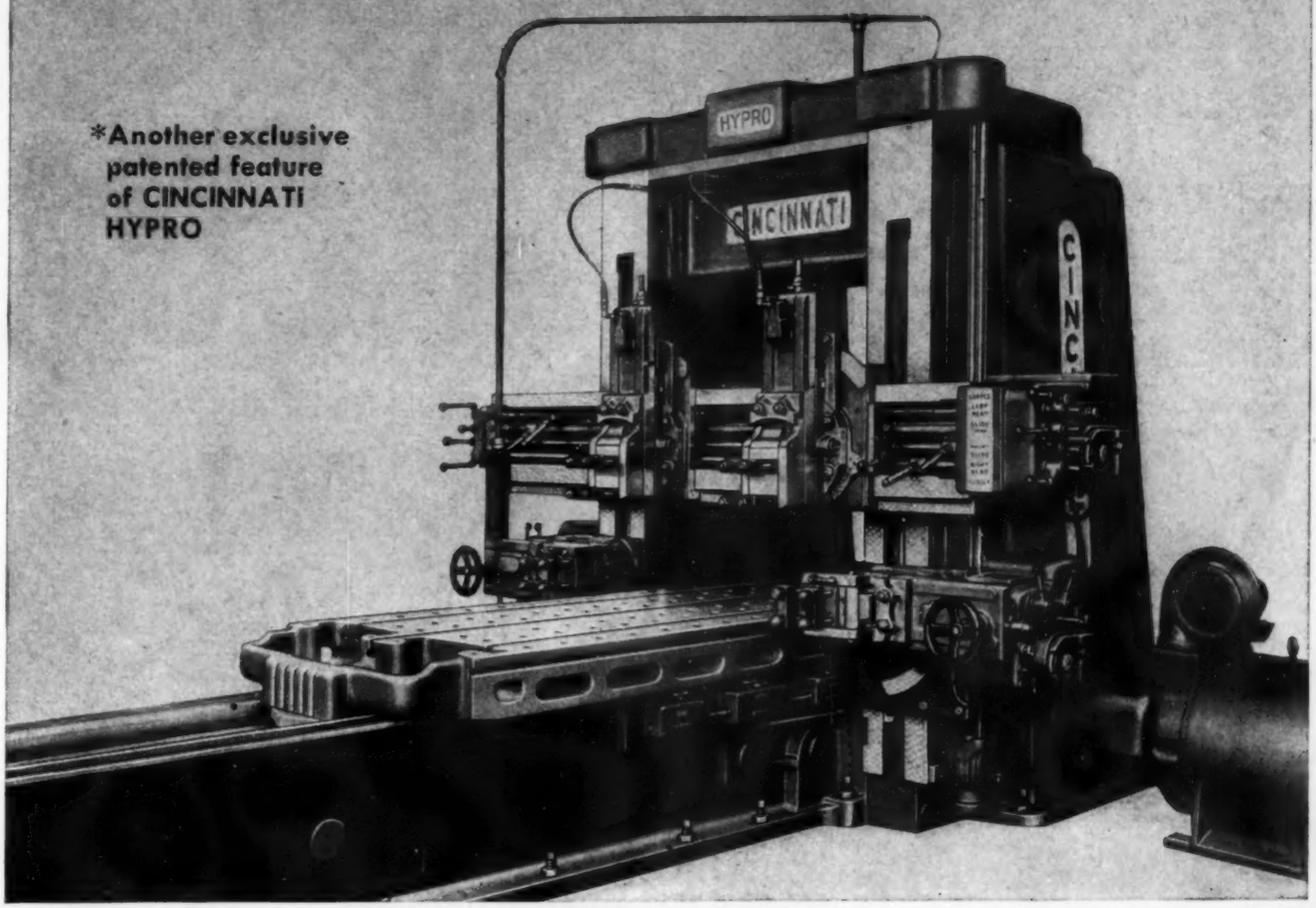
ON AN ORDINARY PLANER TABLE

. . . but not on a CINCINNATI HYPRO

BECAUSE IT IS EQUIPPED WITH

*STEEL TEE SLOT INSERTS

*Another exclusive patented feature of CINCINNATI HYPRO



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Holding Dinographic Comparator Chart on Screen

FOR PRECISION ACCURACY, DIMENSIONAL STABILITY, LOW COST, and EASE of HANDLING . . .

☆

Ask for No. 111-PN . . .
New Catalog of **DI-NOC PHOTOGRAPHIC PRODUCTS...**
available at no charge

OPTICAL

Comparator Charts

Ask for Complete Information About

DINOGRAPHIC

"IT HOLDS SIZE"
SAFETY FILM

REGISTERED U. S. PATENT OFFICE

Coated on Plastic Film Base

DINOGRAPHIC FILM is ideal for Comparator Charts because it has a base of *stable transparent Vinyl Copolymer plastic* of *proved dimensional stability.*

It possesses *all of the desirable properties* of *film plus* the *size accuracy* of *glass* with no breakage problem.

Holds fine lines open, sharp and clear with magnificent density and contrast.

Developing is simple—usual normal steps.

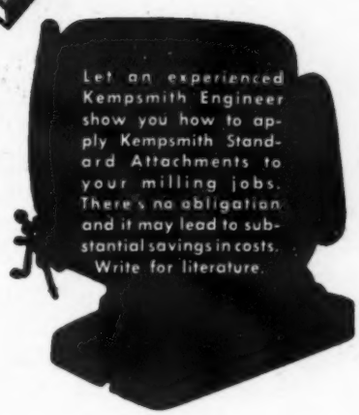
OTHER DI-NOC registered Trade Mark photographic products are: DINOBASE, DINOLOFT, DINOREFLEX, DINOBLUELINE and DINOCLOTH

PHOTOGRAPHIC DI-NOC PRODUCTS

THE DI-NOC COMPANY ★ *Photographic Division*
1700 LONDON ROAD ★ CLEVELAND 12, OHIO

8 Quick Moves TO LOWER MILLING COSTS

Jump at the opportunity to reduce your milling costs by utilizing Kempsmith standard attachments. These precision-built tools make it possible for you to convert your standard milling machine into a special purpose miller, thereby reducing costs to rock bottom. Kempsmith Attachments, Arbors and Accessories have long proven their ability to handle both delicate tool room jobs and fast production runs. They have the same high degree of precision workmanship and accuracy characteristic of Kempsmith machines for more than 57 years. It will pay you to investigate.


Let an experienced Kempsmith Engineer show you how to apply Kempsmith Standard Attachments to your milling jobs. There's no obligation and it may lead to substantial savings in costs. Write for literature.

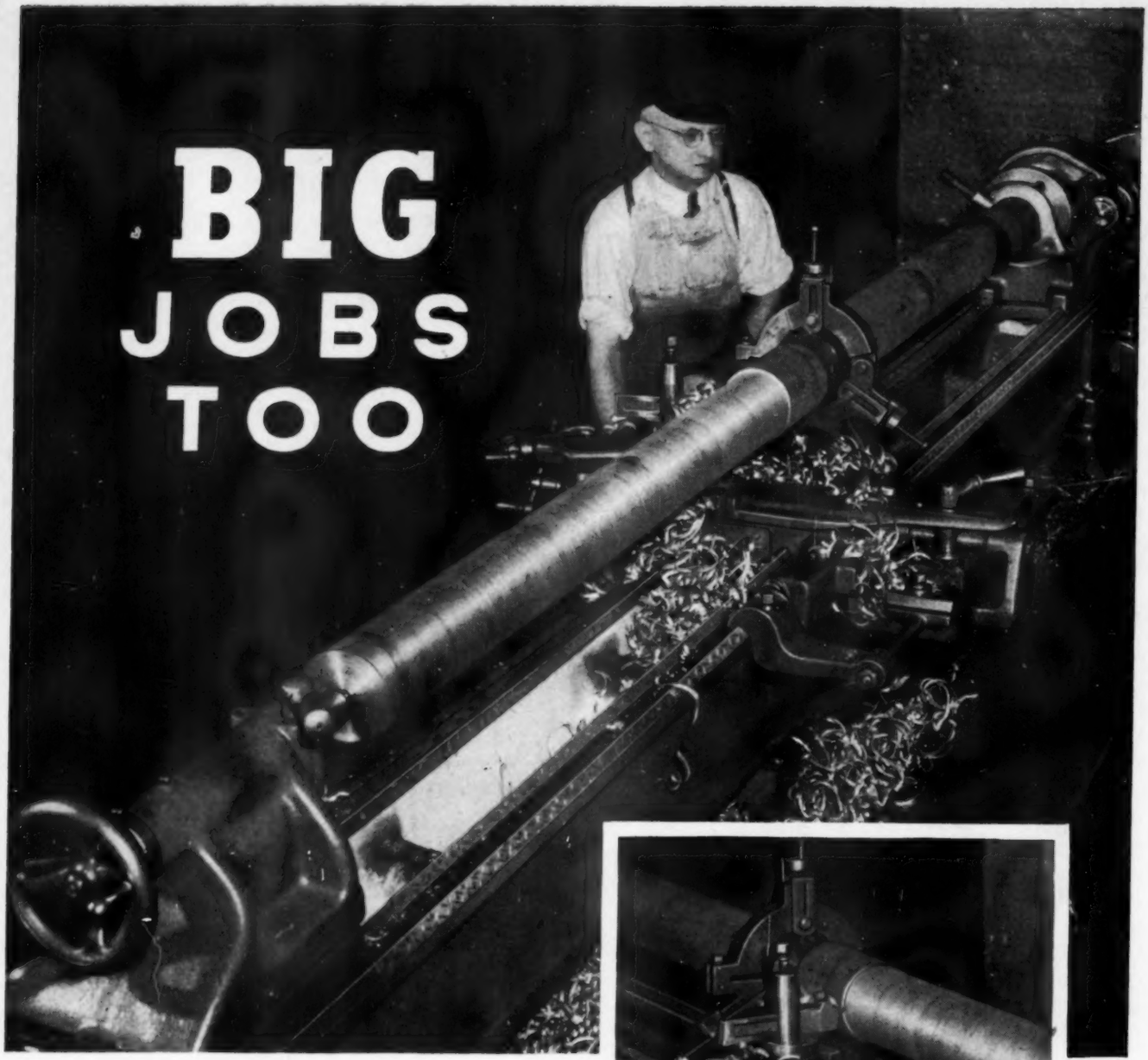
THE KEMPSMITH MACHINE COMPANY, MILWAUKEE 14, WIS., U. S. A.

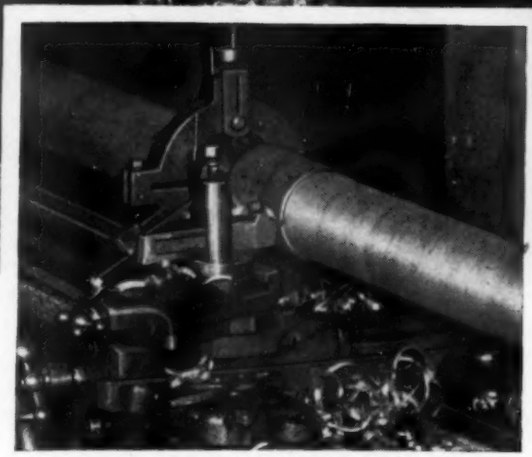
KEMPSMITH *Attachments and Arbors!*

Precision Built Milling Machines Since 1888

A 5076-1P

BIG JOBS TOO





Machining a planer drive shaft on a 16" x 12' South Bend Lathe.

Versatility is always at a premium in toolrooms. Heavy jobs, intricate work, awkward shapes, and the multiplicity of operations all challenge the versatility of toolmakers and their tools.

It is their versatility that makes South Bend Lathes so popular in toolrooms—their capacity for accurately machining anything from tiny instrument parts to heavy jobs like the one shown — plus their ability to perform efficiently a wide variety of machining operations. This is further increased by the many attachments available for simplifying special classes of work. All of which means that you can get more toolroom work done in less time with South Bend Lathes. Toolmakers like them.

Write for a copy of Catalog 100-F which illustrates and describes all sizes and types of South Bend Lathes, attachments, and accessories.

LATHE BUILDERS SINCE 1906

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

HOW TO MAKE

"Veeder-Readings"

COUNT

IN *QUALITY-CONTROL*

OF MANUFACTURING

Here's a Quick "Brief" of How It's Done in One Great Precision Plant:

At the start of a machine-run, pick one finished piece and check it backwards and forwards. Then decide how often the machine should be "patrolled" by the inspector (depending on tolerances, rate of tool wear, and other factors).

Now attach this OK'd part to the Operation Inspection Tag on the machine. This tag has a column of 6 blank lines, headed "*Veeder-Readings.*" And in this column, on each patrol, the inspector writes the date, time, and number of pieces completed up to that time . . . *reading directly from the Veeder-Root Counter installed on the machine.* If the last pieces don't match the first sample, he knows exactly how many pieces must be inspected 100%. Then as the run goes on, if dimensions start "walking out" again, he knows how many pieces to inspect since the last OK'd inspection. And at all times he has an accurate running record of pieces produced. Time and material are saved . . . output kept up.

This is just one instance of Veeder-Root *Count*rol. Find out how you, *in your own way,* can count to your greater profit. Write.

The Counting House of Industry

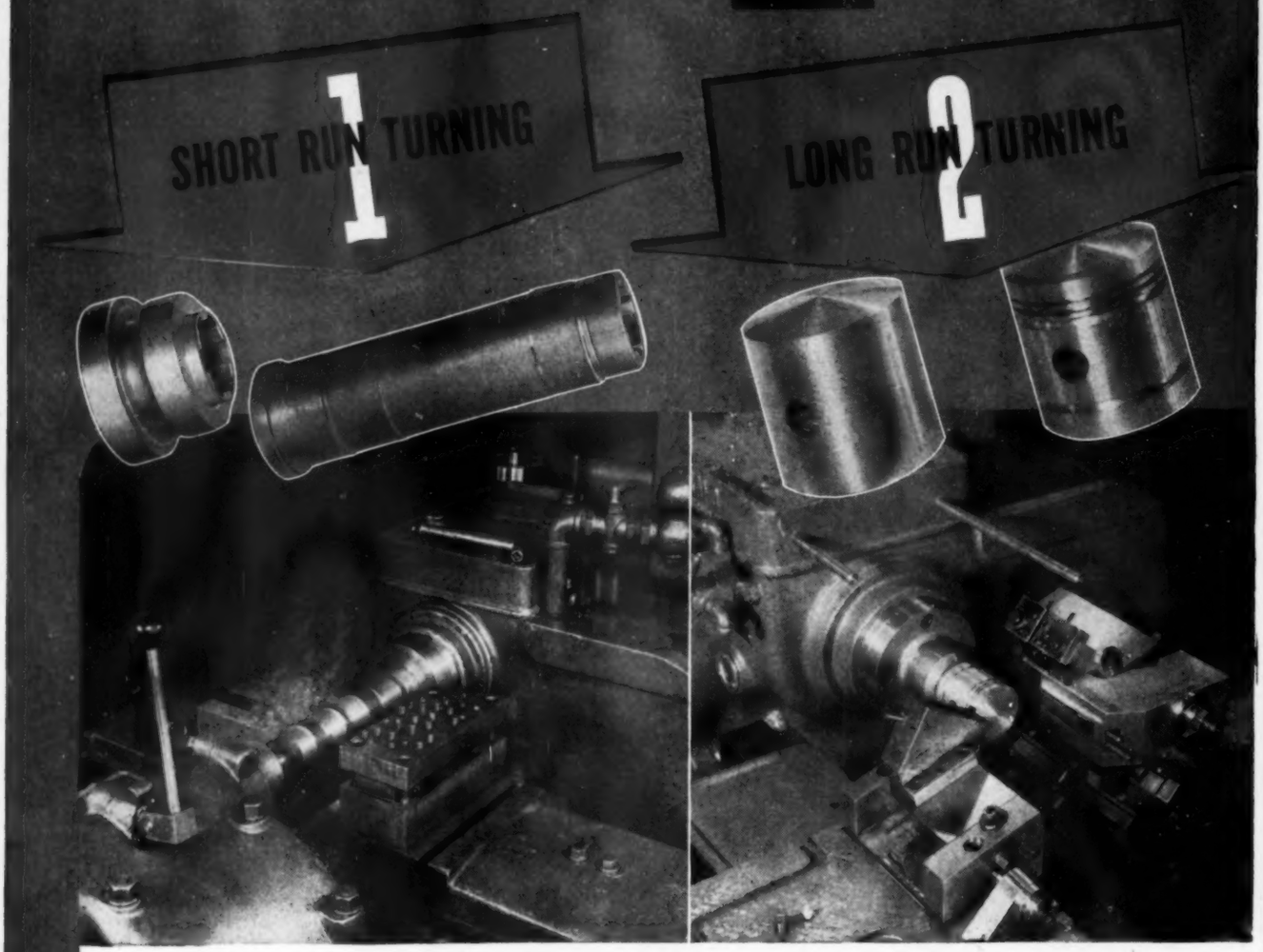
VEEDER-ROOT INC.

Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., Montreal. ***In England:*** Veeder-Root Ltd., Dickinson Works, 20 Purley Way, Croydon, Surrey.

FOR BETTER PRODUCTION AND LOWER

Multiple Tooling Plus Automatic



The two parts shown above are dissimilar and require different tooling setups, yet they are only 2 of the 100 or more parts this manufacturer turns on Standard Sundstrand automatic lathes.

Lot sizes range from 25 to 100 pieces and setup time averages less than 45 minutes. Time savings range up to 43 hours out of 50 hours per lot over former method of machining. Universal and easily adjusted tooling handles most all jobs.

Here's a Standard Sundstrand lathe turning pistons at the rate of approximately 150 per hour. It's tooled to semi-finish and finish turn O. D., finish turn the dome, rough and finish turn ring grooves, chamfer all ring lands and chamfer skirt and dome end. The automatic cycle on this mass production job, makes it easy for an unskilled operator to achieve this production consistently. Multiple tooling, plus automatic cycling also makes it possible to duplicate these parts to close limits consistently.

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS, U.S.A. ·

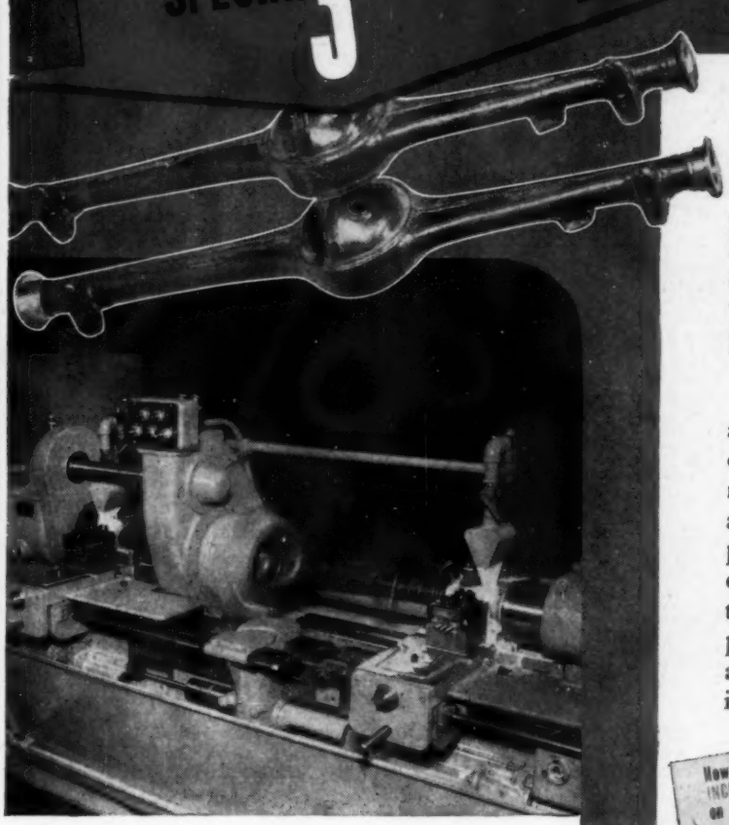
RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

TURNING COSTS USE

Cycling on a.....Sundstrand

AUTOMATIC LATHE

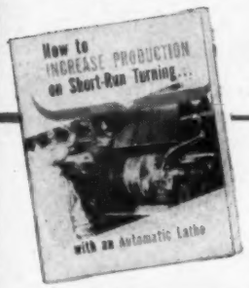
SPECIAL 3 TURNING



This special Sundstrand long bed lathe is tooled to machine both ends simultaneously. In this way, a maximum of machining is done with only one handling of the large rear axle housing. The part is rotated by a center drive while two longitudinal feeding front carriages and two rear cross feeding tool slides machine the ends. After the part is loaded, cycle is automatic, and production reaches approximately 32 pieces per hour.

Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes. Described here are three typical cases in which Sundstrand "Engineered" production assisted plant engineers in designing a tooling method which resulted in lower turning costs.



MORE FACTS FREE

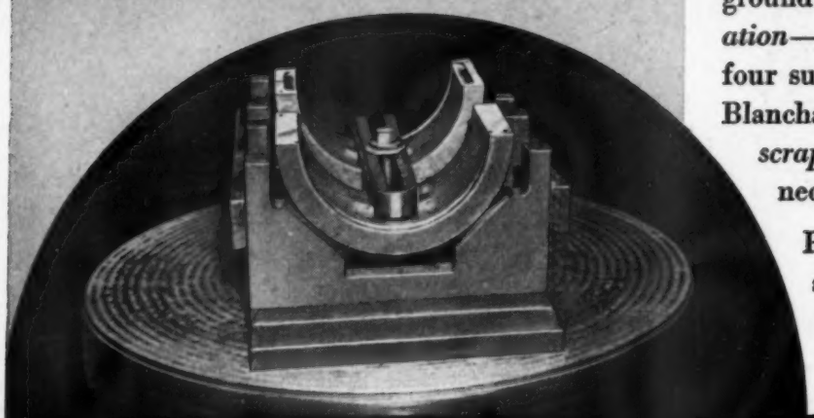
This 44 page booklet will show you many possibilities for applying multiple tooling to your turning jobs. Write for bulletin 158.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

"Put it on the Blanchard"



GRINDING HALVES of TURBINE BEARING

Material: steel and bearing babbit

Size (assembled): 12⅞" O.D., 9⅛" I.D., 7⅝" LG.

Held in an inexpensive fixture on the magnetic chuck of a No. 18 Blanchard Surface Grinder, *both halves* of the turbine bearing are finish-ground at the parting joint *in the same operation*—1/64" is removed from each of the four surfaces. The flatness and finish of the Blanchard-ground surfaces are such that *no scraping* or other means of correction is necessary to provide *oil-tight joints.*

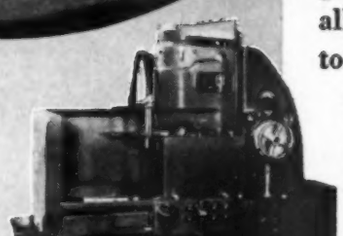
Production is 4 pairs or 8 halves (16 surfaces) per hour. This includes loading and unloading the pieces in the fixture.

The bearing halves are then assembled and held together in a simple clamping fixture. Returned to the Blanchard—*no machine changes are necessary*—both ends of the assembled turbine bearing are finish-ground. (1/64" is removed from each end.) The Blanchard-ground end surfaces are *flat and parallel*, allowing the subsequent finish-boring operation to be registered from either of them.

Production is 8 half bearings (16 surfaces) per hour, which includes assembly and clamping time.

Get These Advantages...

- **PRODUCTION ✓**
- **ADAPTABILITY ✓**
- **FIXTURE SAVING**
- **OPERATION SAVING ✓**
- **MATERIAL SAVING**
- **CLOSE LIMITS**
- **FINE FINISH ✓**
- **FLATNESS ✓**



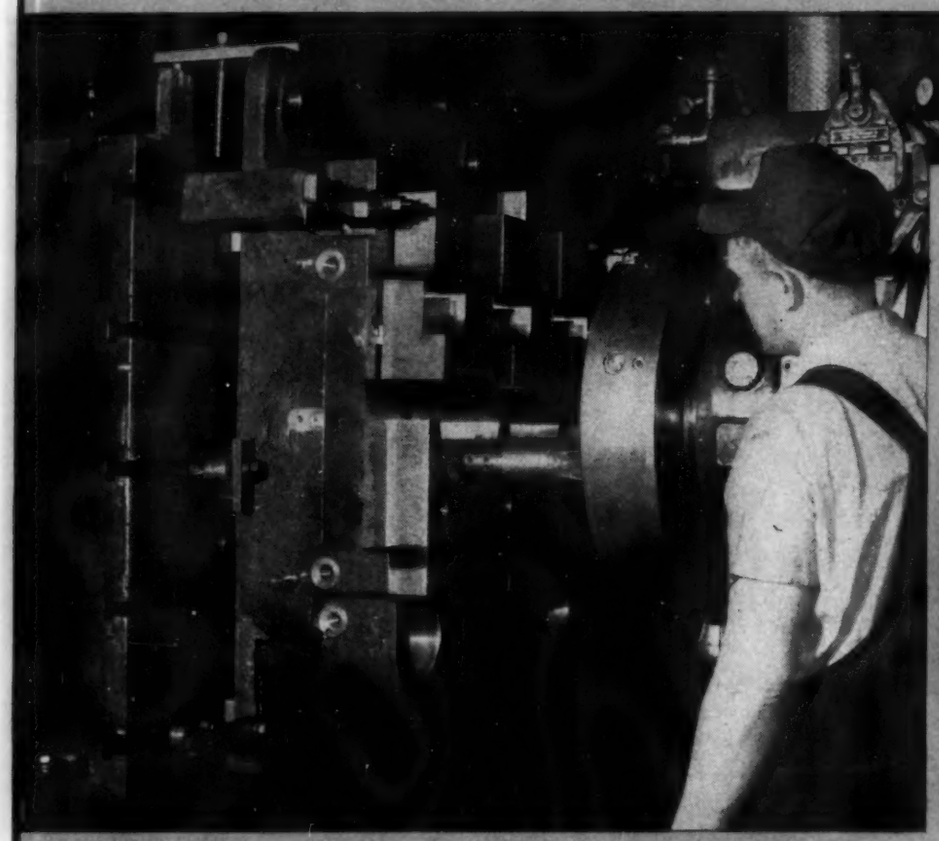
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

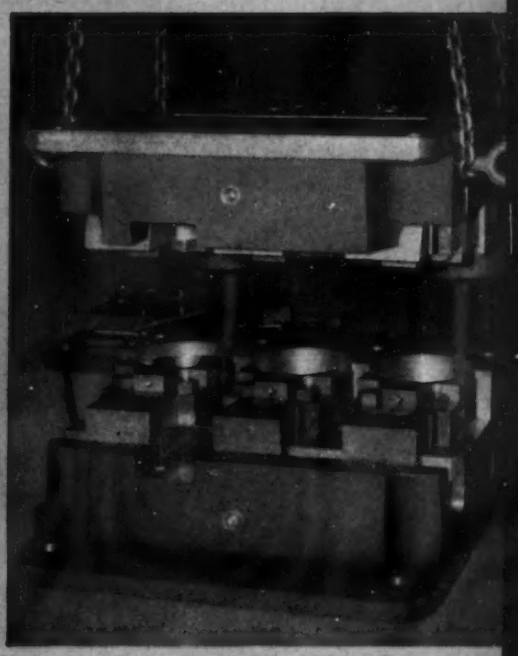
BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Now Danly Special Die Sets





with any additional machining required

New equipment installed in the Danly shop permits us to do any machine work on large or complex die sets incidental to the mounting of the dies. Inserts, recesses, additional boring, keyways and other machining can be done to the customer's specifications.

Time is saved by this service as work on dies and on the die set can be done at the same time. It permits the die shop or tool room to devote their equipment and man hours to the making of dies. The problem of the handling of big sets, for which the die shop or tool room are not generally equipped to do economically, is also solved by this service.

These special die sets are then delivered ready for the mounting of the dies. Note the size and complexity of the die set shown on this page. This die set—machined at Danly—is an example of the additional machining and service which this company offers.

On your next special die set inquiry include the additional machining work that you wish done at Danly while the die set is being made. The cost of this machining will be shown as a separate item in the quotation.

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue • *Chicago 50, Illinois*

Milwaukee 2 . . . 111 East Wisconsin
Detroit 16 . . . . . 1549 Temple Avenue
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DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

Another New Machine Tool Relies On

TIMKEN BEARINGS

The GARVIN "Hi-Power" Automatic Tapper pictured here, with a capacity up to 3" diam. taps in cast iron, is the latest addition to the list of Timken Bearing Equipped machine tools, manufactured by the Western Machine Tool Works, Holland, Michigan.

Timken Tapered Roller Bearings are mounted on all transmission shafts besides the heavy duty splined spindle, for, like all precision machine tools, this automatic tapper requires accurate, dependable operation under very heavy loads and high speeds. Timken Bearings give the assurance of smooth, efficient performance, with reduced operating and maintenance costs.

For years leading machine tool manufacturers have relied on Timken Bearings to carry radial, thrust, and combined loads; to hold moving parts in constant alignment; eliminate friction and wear; simplify lubrication.

By always looking for the trade-mark "TIMKEN" stamped on bearing cups and cones, you will be assured of getting all there is in bearings. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

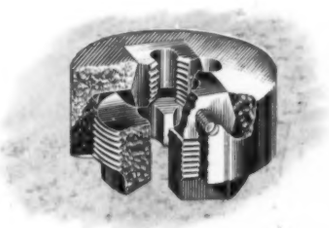
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST —◫— LOADS OR ANY COMBINATION ✳

A DRUMMER OF ACCURACY

Even early in GTD "Greenfield" history, the idea of service to users was considered of prime importance. It was not enough to build a better tap or die. It was necessary to show how these new tools would cut more accurate threads. In a sense, these early GTD "Greenfield" pioneers, travelling around the country by horse and buggy, were salesmen of accuracy.

In the same tradition of service is GTD "Greenfield's" large staff of field engineers today, located in every industrial center in America. With ever better threading tools goes ever increasing knowledge of how to use them for best results.

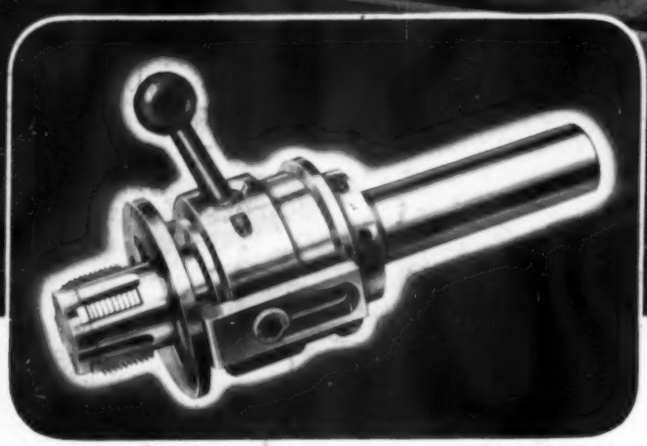
The "Little Giant" Screw Plate, introduced in the 1870's, set a standard for accuracy and strength in cutting screw threads by hand which has never been surpassed. In use today all over the world, the "Little Giant" Die consists of a two-piece, bevel-sided die that fits into corresponding bevels in a collet and is held in place by a guide.



GTD Greenfield 75th YEAR

GREENFIELD TAP and DIE CORPORATION
Greenfield · Massachusetts

The GEOMETRIC TOOL COMPANY
New Haven, Connecticut · In Its Fifty-Fourth Year
A DIVISION OF GREENFIELD TAP and DIE CORPORATION



"GEOMETRIC" COLLAPSING TAPS . . . The "Class S" Geometric Collapsing Tap shown above is a popular tool in use today for cutting internal threads over 1¼" in diameter. It can be used on almost any type of machine and can be easily converted from one type of trip to another as required. If you have an internal threading job of 1 5/16" diameter or larger, write for complete details and prices on this tap.

Backing GEOMETRIC Threading Tools . . .

The Geometric Tool Company of New Haven, Connecticut, has built an organization capable of giving prompt and intelligent attention to every customer's threading tool requirements.

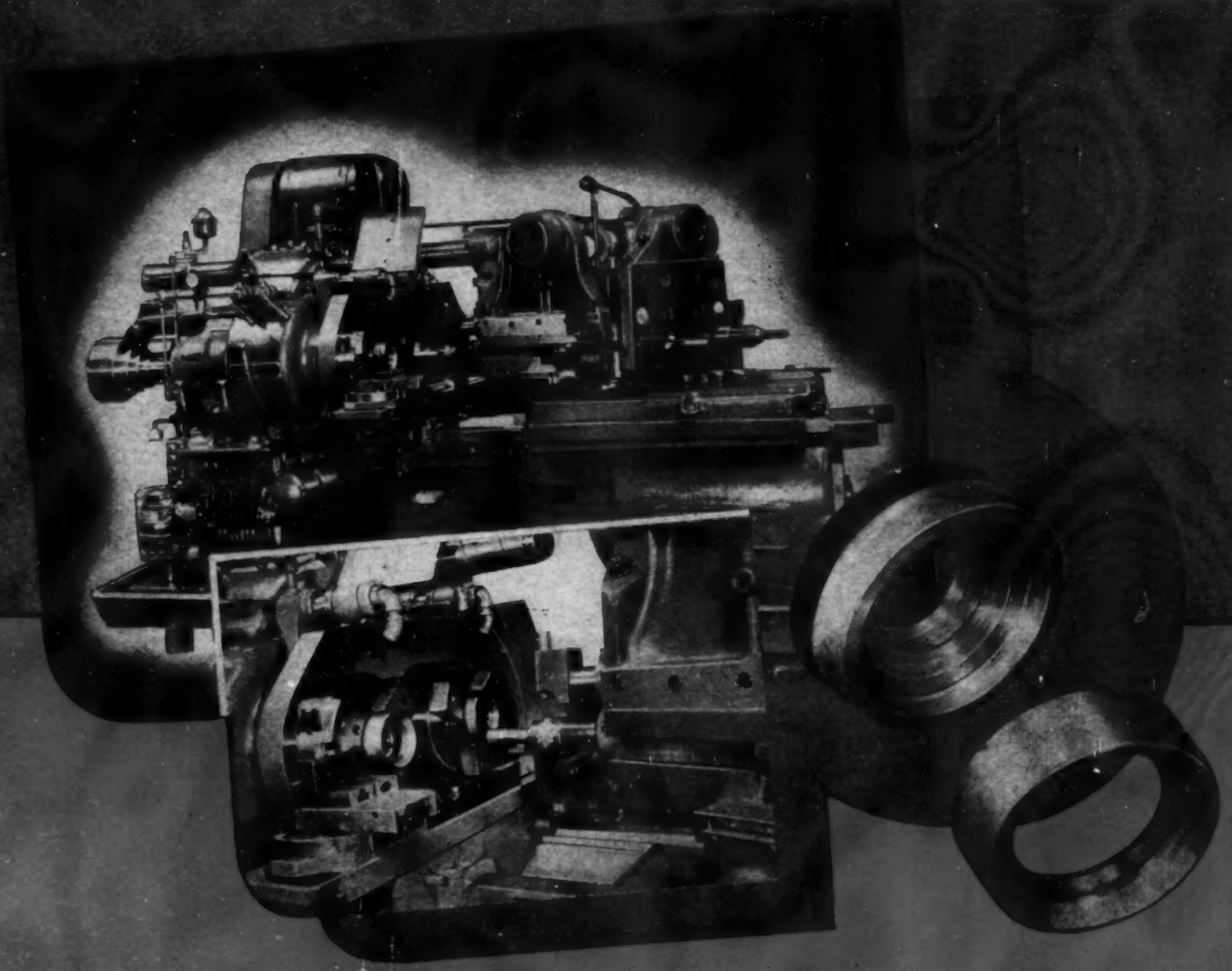
Here are some of the people in the modern Geometric Sales and Service Department. Inquiries and orders come in from all over the world. Here the customer's needs are studied and consultations with Geometric engineers assure the proper tool and chasers for nearly every kind of threading work — often for that very unusual job. From here, too, Geometric keeps in touch with its large sales and service organization in the field.

• *"Threads", published regularly by Geometric in the interests of screw thread cutting, is one of the oldest company house organs in America. It has thousands of reader friends all over the world. Are you receiving it? If not, write for a copy on your company letterhead.*

THE
GEOMETRIC
TOOL COMPANY · NEW HAVEN 15, C
A Division of Greenfield Tap and Die Corporation

High production requirements are met with double set up on this

P&J 5 · D2-12" TWO SPINDLE AUTOMATIC



The part is a commutator ring of 1040 Cut-off Steel. All operations in complete finishing are performed on the two spindle of a P & J 5D2-12" Automatic. Close limits of accuracy are maintained at high production rates with least possible effort on the part of the operator.

The nature of the job and the quantity of parts involved in this case were such as to recommend the use of a two spindle machine. Special tooling was developed by P & J engineers to attain maximum production in minimum floor-to-floor time and with simplest possible set-up requirements.

P & J Two Spindle Automatics, are made in three sizes, thereby making their outstanding productivity available on a wide range of work. Versatility in tooling makes change over a comparatively simple matter.

Consult P & J engineers on your duplicate parts production problems.

DETAILS OF JOB

1st Rear Spindle

Procedure: Grip partway over O.D. with 3 chuck jaws.

Machine as follows:

1st T.F.—Drill hole through (approx. 2½" dia.); rough turn O.D. to jaws.

2nd T.F.—Rough machine C. Bore; face end; rough bore hole; chamfer edge of bore; form portion of O.D.

3rd T.F.—Finish face C. Bore; face rim (Slide Tool).

4th T.F.—Finish bore C. Bore.

5th T.F.—Blank—rear spindle only.

2nd Front Spindle

Procedure: Presenting finished end to spindle; grip in C. Bore with 3 jaws turned to suit; position against web with 3 position stop pins in chuck.

Machine as follows:

1st T.F.—Rough bore 3.007" dia.; rough turn portion of O.D. (straight).

2nd T.F.—Rough form 30° angle; form face web; face end.

3rd T.F.—Finish face web (Slide Tool); form portion of O.D.

4th T.F.—Reduce gripping pressure; finish bore hole; form radius at rim of 30-30° angles.

5th T.F.—Generate 30-30° angles.

POTTER & JOHNSTON MACHINE COMPANY

Pawtucket, Rhode Island

Using Automatic Production Milling

• On this job the machine runs continuously—automatically performing all movements. The operator merely loads and unloads the fixtures.

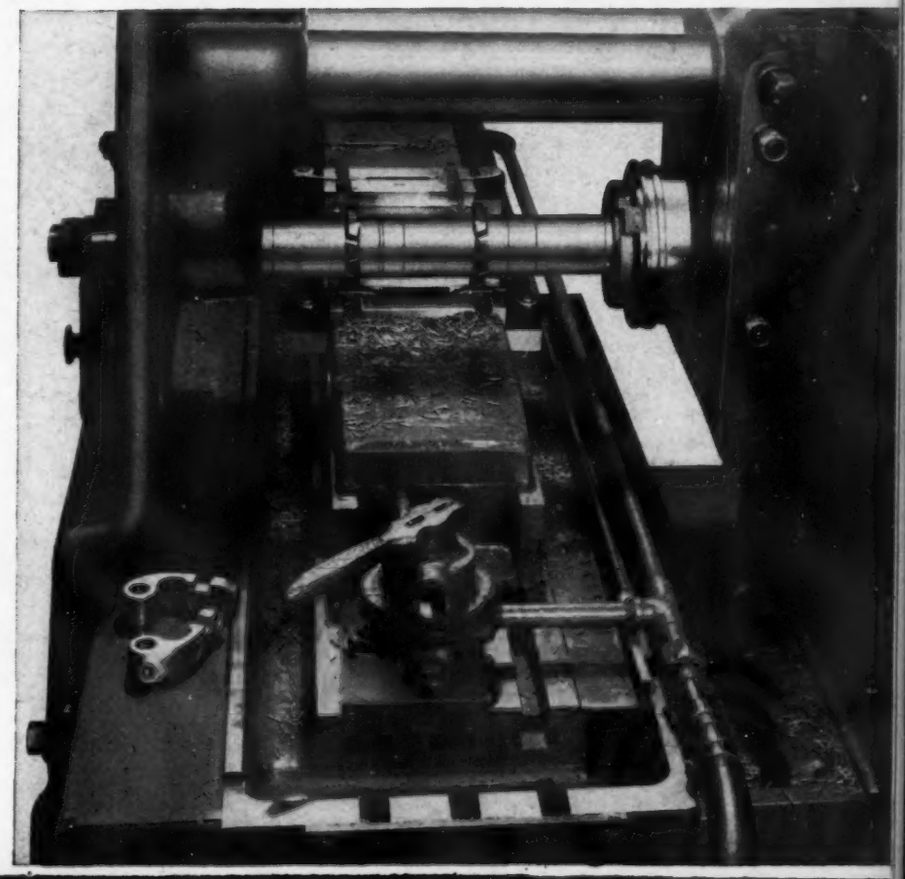
Two opposed slots are milled in cast iron bar arms used on textile machines. Two pieces are held in each of two air-operated fixtures, one at each end of the table. Using one set of cutters, the pieces in one fixture are climb milled and those in the opposite are conventional milled.

A feed of 7″ per minute is used, limited by the ability of the operator in loading to fit the bar arms over pins for location of the slot.

The only non-productive time on this job is that required for power fast travel (at 300″ per minute) between fixtures.

BROWN &

Cycle on No. 12



This is typical of the performance for which the No. 12 was designed. It has unusual flexibility of performance for a wide variety of short-run, or long-run jobs. Complete electrical control for all table and spindle power movements is just part of its unique combination of design features. A wide range of automatic milling cycles—more than 16 with standard dog equipment . . . is another. Set-up adjustments are made from the front of the machine. Operating controls are conveniently grouped and simple to use. Operator and machine are protected with numerous safety devices. Write for fully illustrated bulletin on the No. 12 Plain Milling Machine.

Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE B·S

Even on today's toughest Steels CSM's give you Astounding

Slot in S.A.E. 3145 Forging Milled in one pass — metal removal: 21.8 cu. in. per minute!

WORKPIECE: Connecting link used in mining machinery

MATERIAL: S.A.E. 3145 Forging

HARDNESS: 190-200 Bhn

OPERATION: Mill slot 1 13/64" wide x 2¼" deep*

CUTTER: 10" diam. carbide (Lovejoy Slotting)

SPEED: 117 rpm (306 SFM)

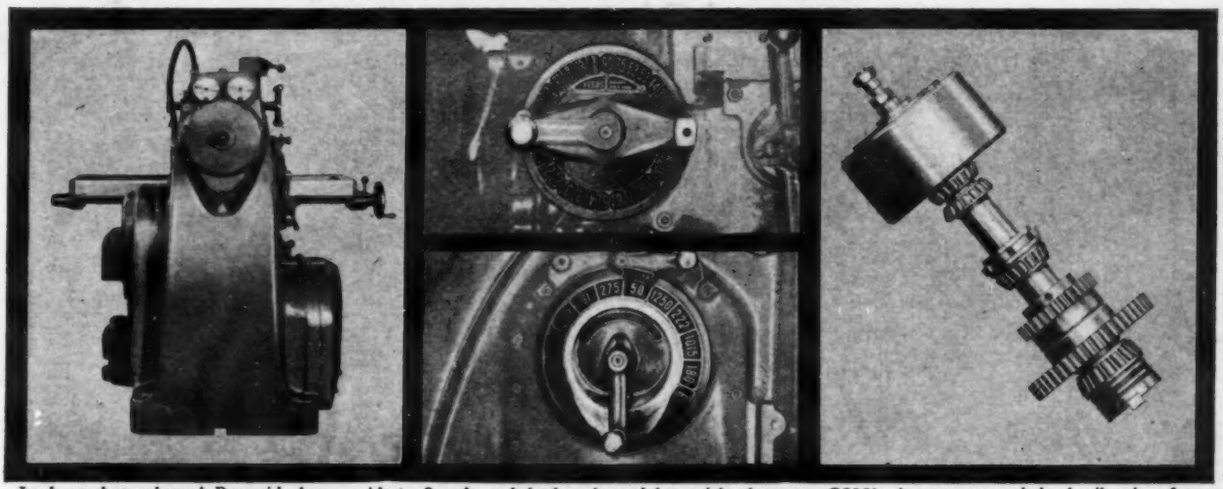
FEED: 7.75 ipm (.0065" per tooth)

RATE OF METAL REMOVAL: 21.8 cu. in. per minute

*Milled in single pass from solid metal section.

Kearney & Trecker super-power new rates of metal removal!

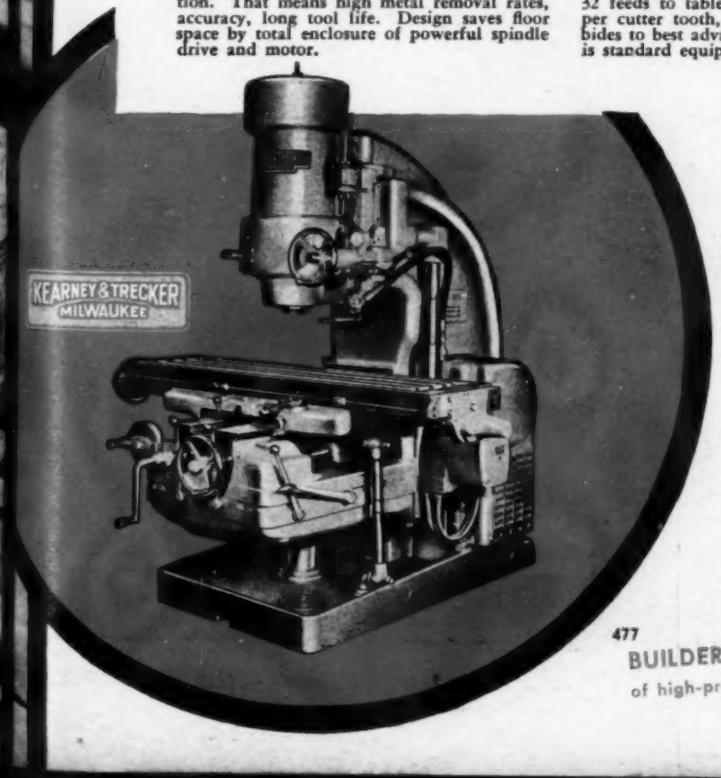
These new super-power Kearney & Trecker CSM's use carbide cutters to fullest efficiency —set amazing new high standards of ferrous and non-ferrous metal removal.



Look at that column! Pyramid shape, wide base, solid back, box-type ribbing give you maximum rigidity and vibration-free operation. That means high metal removal rates, accuracy, long tool life. Design saves floor space by total enclosure of powerful spindle drive and motor.

Speeds and feeds selected by quick-change dials. Choice of 16 spindle speeds mean right cutter speed for use on almost any material. 32 feeds to table and knee mean right feed per cutter tooth, a key factor in using carbides to best advantage. Separate feed motor is standard equipment.

CSM's incorporate original vibration-free three-bearing spindle design. Flywheel, now an integral part of spindle, insures constantly smooth flow of power to cutter. Electrical controls for acceleration and deceleration of gear train are part of basic design. Control interlocks protect operator, cutter and workpiece.



IMPORTANT NOTICE!

Because CSM's are different from any other milling machines — only a check of your production by an experienced Kearney & Trecker engineer, trained in the use of CSM's, can show you the tremendous savings possible. CSM's are made in Plain and Vertical types with 20, 30, and 50 hp. For an on-the-spot personal analysis of how CSM's can increase your production, *wire us collect*. There is no obligation.

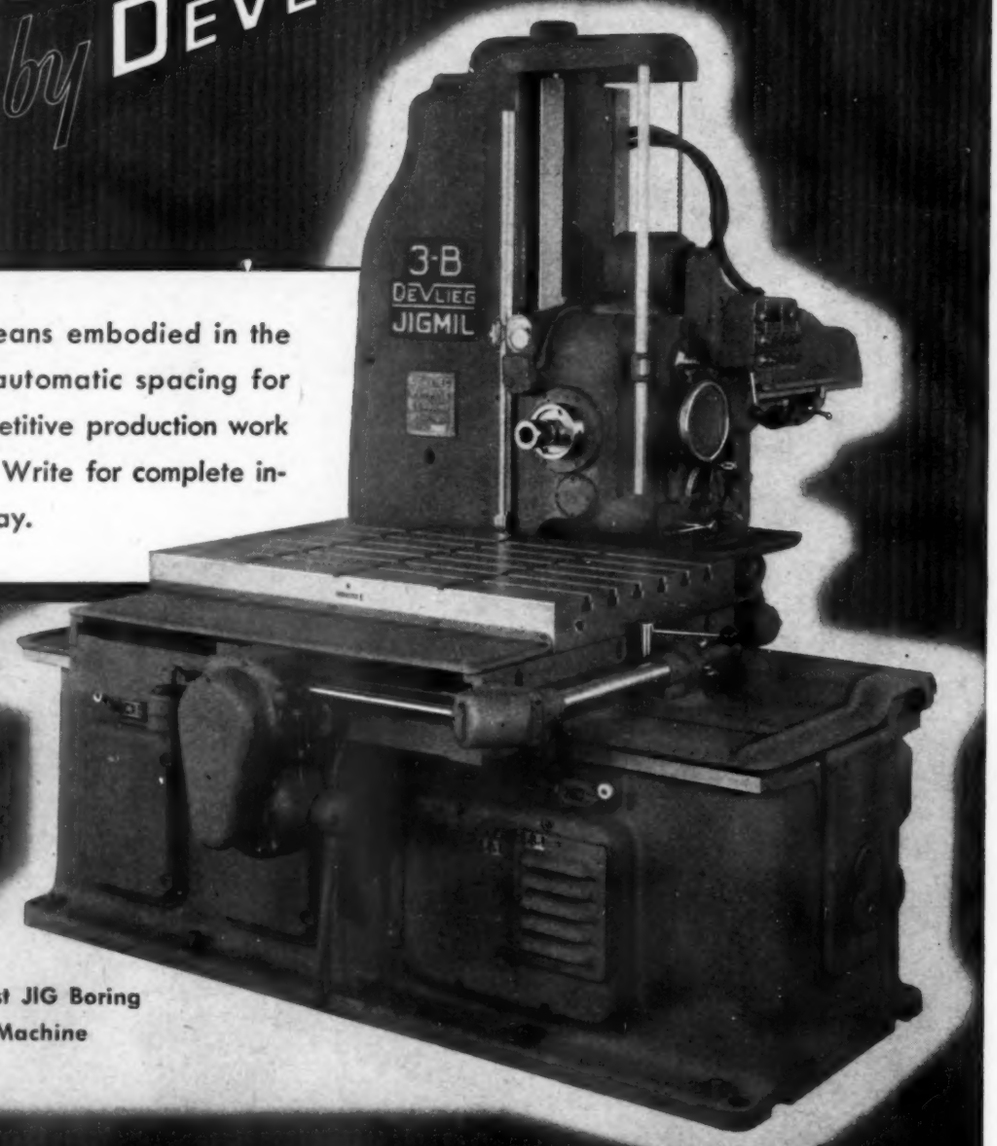
KEARNEY & TRECKER CORPORATION
MILWAUKEE 14, WISCONSIN

477

BUILDERS OF 97 DIFFERENT MODELS AND SIZES
of high-production precision milling machines — power rated for every job.

Announcing

DUPLITROL *by* DEVLIEG



● A new means embodied in the JIGMIL for automatic spacing for duplicate repetitive production work without JIGS. Write for complete information today.

The World's Finest JIG Boring and Milling Machine

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"With GULF L. S. Cutting Base we increased production, doubled broach life, improved work accuracy and finish"

says this Foreman

The Department Foreman consults with a Gulf Lubrication Engineer (right) on results with Gulf L.S. Cutting Base in broaching various business machine parts.

"MAINTAINING production on our vertical broaching machines is no longer a problem since we switched to Gulf L.S. Cutting Base," says this Foreman. "In addition to greater output, we get 100 per cent longer broach life, improved work accuracy, and a better finish with this quality cutting oil."

This is one of hundreds of shops that have increased production and tool life on precision work by using the proper Gulf Cutting Oil for each particular requirement.

Gulf Quality Cutting Oils

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Gulf L. S. Cutting Base A and B
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Gulf Cutting Oils established many records on the toughest steels and the most punishing schedules offered by the armament and aircraft industries. You'll find them helpful now in improving production and tool life, and in reducing costs below competitive levels.

Let a Gulf Lubrication Engineer show you why Gulf Cutting Oils are ideal for many of your machining jobs. Write, wire, or phone your nearest Gulf office today.

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GULF INDUSTRIAL LUBRICATION

LOCK JAW *Stops*

SLIDING

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HANDY *New All-Purpose* CLAMP

Eliminates expensive clamping and bolting operations. No more hunting around the shop for straps, bolts, washers, nuts or scrap pieces to wedge or lock your work in position. No oddly and awkwardly contrived, odd-sized and makeshift locks, limited in their ability to wedge and hold.

Now LOCKJAW gives you positive, powerful two-way locking, sure grip pressure downwards and side-ways. It may be set at any angle on the table and held by the T-slot bolt. Then LOCKJAW pressure is applied to one or more pieces of stock by simply adjusting Capstan Jack Screw.

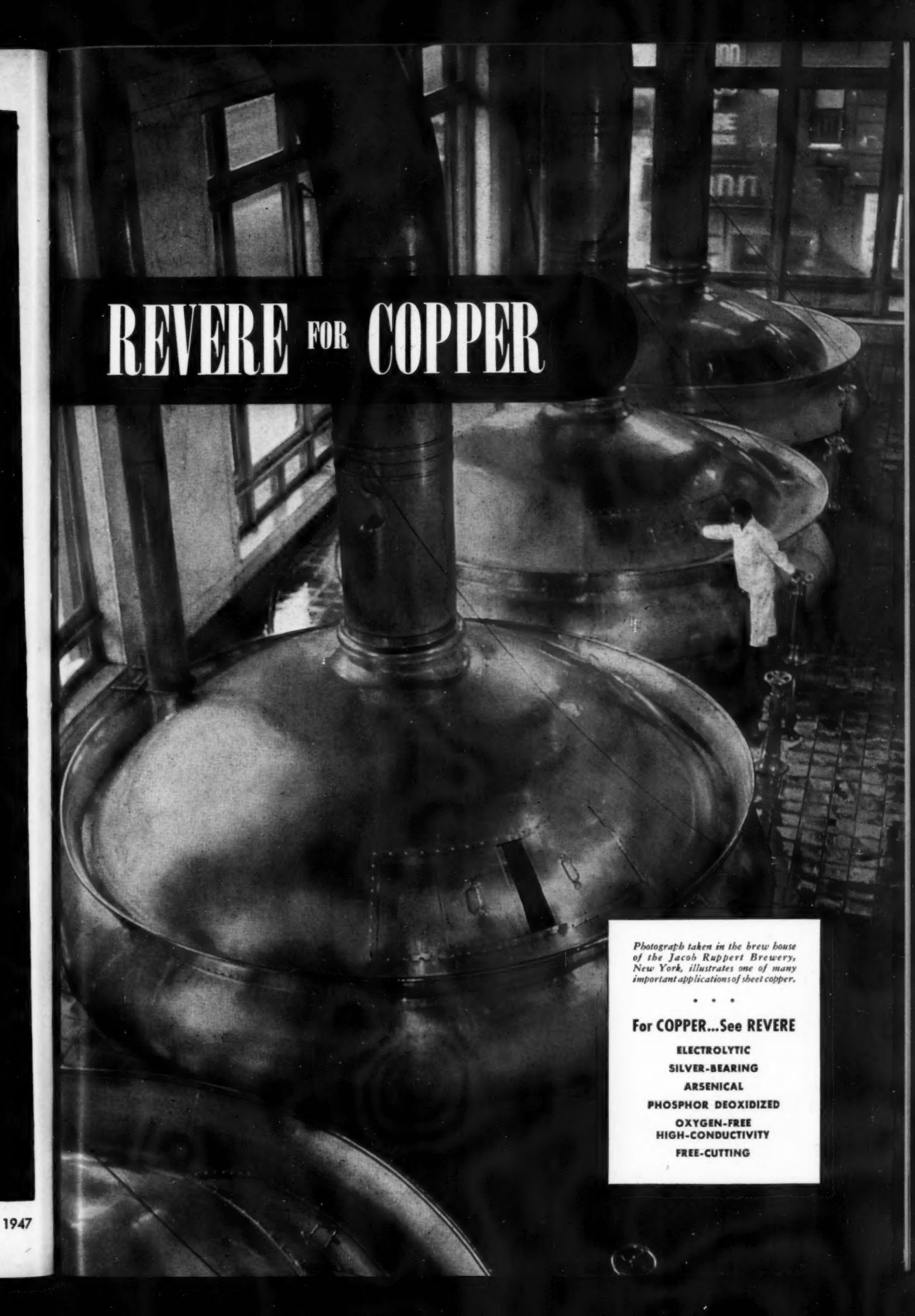
Setting up or taking down is a quick and simple operation. Every machine shop, tool room, or metal working unit can find many handy uses for this new Rivett conceived clamp on their planers, radial drills, shapers, milling machines, surface grinders and boring mills.

You, too, will save time, trouble and inconvenience when you use LOCKJAW to eliminate cumbersome and awkward clamping.

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON • BOSTON • MASS. • U. S. A.



Photograph taken in the brew house of the Jacob Ruppert Brewery, New York, illustrates one of many important applications of sheet copper.

• • •

For COPPER...See REVERE

ELECTROLYTIC

SILVER-BEARING

ARSENICAL

PHOSPHOR DEOXIDIZED

OXYGEN-FREE HIGH-CONDUCTIVITY

FREE-CUTTING

REVERE COPPER

"THE METAL OF INVENTION"

Revere considers its copper "The Metal of Invention" because it is so easily adaptable to such a wide variety of uses, applications and processes. Its easy workability sets the designer free; complicated parts and equipment can be produced easily and economically, while its many other inherent qualities make it invaluable.

Copper, however, is more than just *copper*. By making slight changes in composition, Revere copper is produced in six different types, each having special characteristics to meet varied needs with exactitude. If you need just the right copper to fill your requirements as to fabrication or use, come to Revere.

General Qualities. One of copper's most important qualities is its ability to resist corrosion. It withstands atmospheric conditions as satisfactorily as any available commercial metal, and in addition it is substantially immune to attack by a large number of chemicals . . . Copper also has high electrical and thermal conductivity . . . Fabricators find its hot and cold working properties unsurpassed. In cold working, reductions of 90% may be achieved without intermediate annealing. In hot working, temperature is not critical, the range of maximum plasticity being between 1200° and 1650° F. . . . Copper may be easily drawn, stamped, and formed by machine or hand, and easily soldered, polished, plated . . . Most coppers can be welded by gas, carbon arc or metal arc.

ELECTROLYTIC COPPER

Contains 99.9% copper, minimum.

Produced in sheet, strip, plate, rod, bus bar, tube, forgings.

Typical uses: Bus bar, commutators, roofing, flashing and gutters, kettles, vats, chemical and distillery equipment, forgings, printing rolls.

Also known as tough-pitch copper, this is the most widely-used type of Revere copper, combining as it does high electrical and thermal conductivity with resistance to corrosion. Working properties: Cold working, hot working, soldering, polishing—excellent. Machining—fair. Welding—deoxidized copper preferred.

SILVER-BEARING COPPER

Copper 99.9% minimum; silver, 8 to 30 oz. per ton.

Produced in sheet, strip, rod, tube.

Typical uses: Radiators, gaskets for spark plugs, commutators, and other parts subjected to high temperatures, wherever copper is required to have high annealing qualities.

The silver content of this copper raises its annealing temperature, so that the metal resists softening at 500° to 700° F. Electrical and thermal conductivity are the same as Electrolytic copper. Working properties: Cold working, hot working, soldering, polishing—excellent. Machining—fair. Welding—deoxidized copper preferred.

ARSENICAL COPPER

Copper 99.45%, arsenic 0.35%, phosphorus 0.025%.

Produced in tube form only.

Typical uses: Tubes for condensers and heat exchangers.

This special copper has lower electrical and thermal conductivities than Electrolytic. Due to its resistance to the chemical action of certain corrosive media, arsenical copper has found some application in tubes for condensers and heat exchangers. Working properties are the same as Electrolytic.

PHOSPHOR DEOXIDIZED COPPER

Copper 99.9%, phosphorus 0.025%.

Produced in sheet, strip, plate, rod, tube.

Typical uses: Water, oil and refrigeration lines; heat exchangers, stamped and spun products and parts, welded construction of vats, tanks, stills and similar equipment.

Has better forming and bending qualities than Electrolytic, hence its selection when severe forming is required. It is also generally preferred for welding applications because at welding temperatures it resists embrittlement by reducing gases. Working properties: Cold working, hot working, soldering, polishing—excellent. Machining—fair. Welding—excellent.

OXYGEN-FREE HIGH-CONDUCTIVITY COPPER

Copper 99.9% minimum

Produced in sheet, strip, rod, tube.

Typical uses: Drawn and stamped parts; metal-to-glass seals, as in vacuum tubes; equipment operated at elevated temperatures in presence of reducing gases.

Revere Oxygen-Free Copper has excellent drawing and forming properties, similar to those of Phosphor Deoxidized, and retains the highest electrical conductivity. Because of its freedom from oxygen it does not become embrittled when exposed to reducing gases at elevated temperatures, as in forming seals with glass and similar applications. It is less suitable than Deoxidized Copper for general welding purposes because of the absence of residual deoxidant. Working properties: Cold working, hot working, soldering, polishing—excellent. Machining—fair. Welding—neutral flame or arc.

FREE-CUTTING COPPER

Copper 99.75%, tellurium 0.70% maximum.

Produced in rod, extruded shapes.

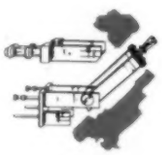
Typical uses: Screw-machine products, electrical parts requiring accurate machining, welding torch tips, parts for electronic tubes.

Revere Free-Cutting Copper is similar in qualities to Deoxidized Copper, but in addition has remarkable machinability, being rated in excess of 70% of free-cutting brass. Parts produced from it have close tolerances, an exceptional finish, sharp threads. Working properties: Cold working, hot working, soldering—good. Machining, polishing—excellent. Welding—not recommended.

SPECIAL FORMS

SPECIALLY-PREPARED SWITCH COPPER

Copper 99.9%.



Developed to bring new economy to manufacturers requiring flat copper conductors with a minimum of contact losses. Mirror finish is superior to commercial-quality copper bar, reducing costly polishing. Tolerances on flatness measured across width are unusually close. Working properties: Same as Electrolytic.

COMMUTATOR COPPER

Produced in lengths or segments.

Commutator copper is made in the form you require, either in lengths of the proper cross-section, or in segments ready for assembly with a minimum of finishing. Offered in Electrolytic, Oxygen-Free High-Conductivity, or Silver-Bearing copper.

FORGINGS AND EXTRUDED SHAPES

Revere produces forgings and extruded shapes in the types of copper suitable for such operations. These special forms, made to your specifications, may make possible remarkable economies in your plant; forgings will require a minimum of finishing operations; extrusions likewise. Consult Revere.

OTHER REVERE COPPER PRODUCTS

Fire extinguisher sheets, special temper and finish · Dairy sheets, specially rolled and heavily tinned · Anodes and anode hooks · Soldering coppers · Coppersmith sheets.

TECHNICAL DATA—Technical data on the various types and forms of Revere Copper are available on request. Ask for the new edition of "Technical Information on Revere Copper and Copper Alloys."

SELECTION OF COPPER—Copper is one of the most useful and versatile of man's metals. Its applications are endless. Among the various types and forms of Revere Copper there must be one or more that match your needs perfectly. If you are contemplating a new use, having difficulty with the copper you now use, or wonder if a better choice can be made, the Revere Technical Advisory Service will gladly cooperate with you, making an analysis of all factors and making definite recommendations.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.

TWIST DRILLS

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UNION

SAWS

GROUND FORM TOOLS

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THE TOOLS YOU BUY AGAIN!

Union can supply the correct tool for almost every job of metal removal—drills that cut cleanly and evenly, cutters that BITE . . . and keep biting. Union tools enable you to take full advantage of the production potential of your machines. Try them on your toughest jobs, and we are sure they'll become — "the tools you buy again!"

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"Thred-Rite" DIES

Graduated micrometer lock nut adjustment can be set to split thousandths! Full floating design assures accurately centered work! Rugged construction holds accuracy under high speed, heavy duty operation! Use the simple, accurate, efficient "Thred-Rite" Die on jobs where accuracy must be maintained with minimum attention. They are built in a full range of standard sizes, with NC or NF threads, in carbon or high speed steel. Get full details from your nearest Butterfield store.

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CARD

THE RIGHT ANSWER TO EVERY TAPPING PROBLEM

More and more tap users are specifying CARD for every tapping job. They know that it pays to go to a specialist. They know that they can get the right answer to every tapping problem from this single, convenient, complete source of supply. They know that—in the test of service—Card Taps have given them long runs of threads, high output on all types of materials and under all conditions, and precision results that satisfy their most exacting demands.

S. W. CARD MFG. CO.

MANSFIELD, MASS.

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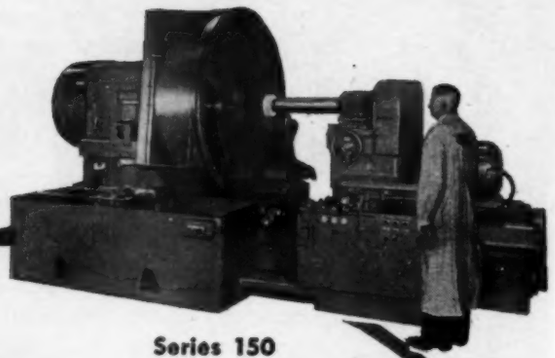
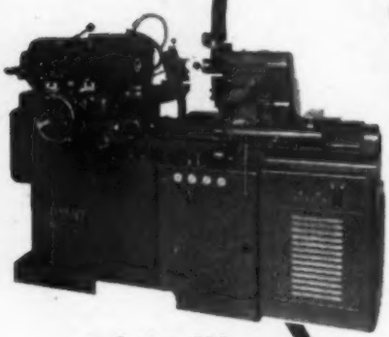
A fine line

of Internal Grinders for every tool room and production requirement



Series 150

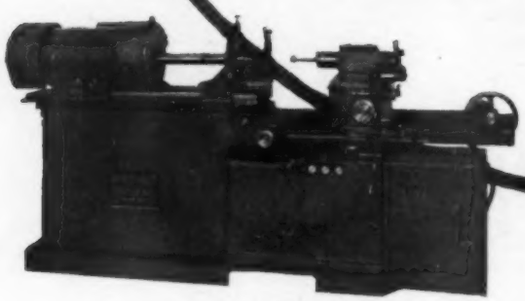
Series 107



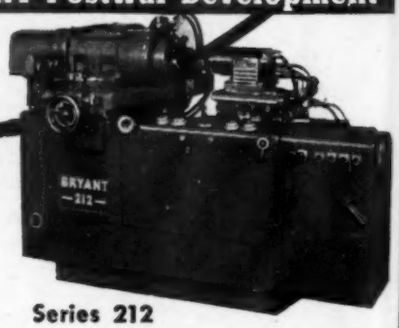
Series 112

BRYANT has designed and built precision internal grinders for 38 years. Today, their completely modern line covers the grinding of holes from .040" to 50" in diameter. Standard and special machines will grind straight, tapered, curved and irregular holes, or any of these in combination. Face and hole grinding can be combined to assure squareness. Cams and irregular holes can be ground by using the cam attachment. The Series 150 has a face plate 60" in diameter and will swing work up to 50". A special machine will take 100" swing. The Series 107 is equipped with Bryant High Frequency wheelheads giving speeds up to 100,000 R.P.M. for extremely small bores. Maximum swing of the 107 is 9". Series 112 machines are for general purpose tool room work. They incorporate many quick-changeover features and will swing 16". The 112-M machines are similar to the 112, but have provision for grinding long bores such as machine tool spindles. Series 212 grinders are completely automatic and will grind bores from 5/16" to 6" in diameter. The High Frequency head is used on the 212 for maximum efficiency on small bores. All these machines incorporate the exclusive Bryant feature of hardened and ground cylindrical slide construction and three-point bearing. Complete specifications are available on all Bryant precision internal grinders — write today.

BRYANT Postwar Development



Series 112 M



Series 212

Send for the Man from

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

BRYANT

Competition Ahead!

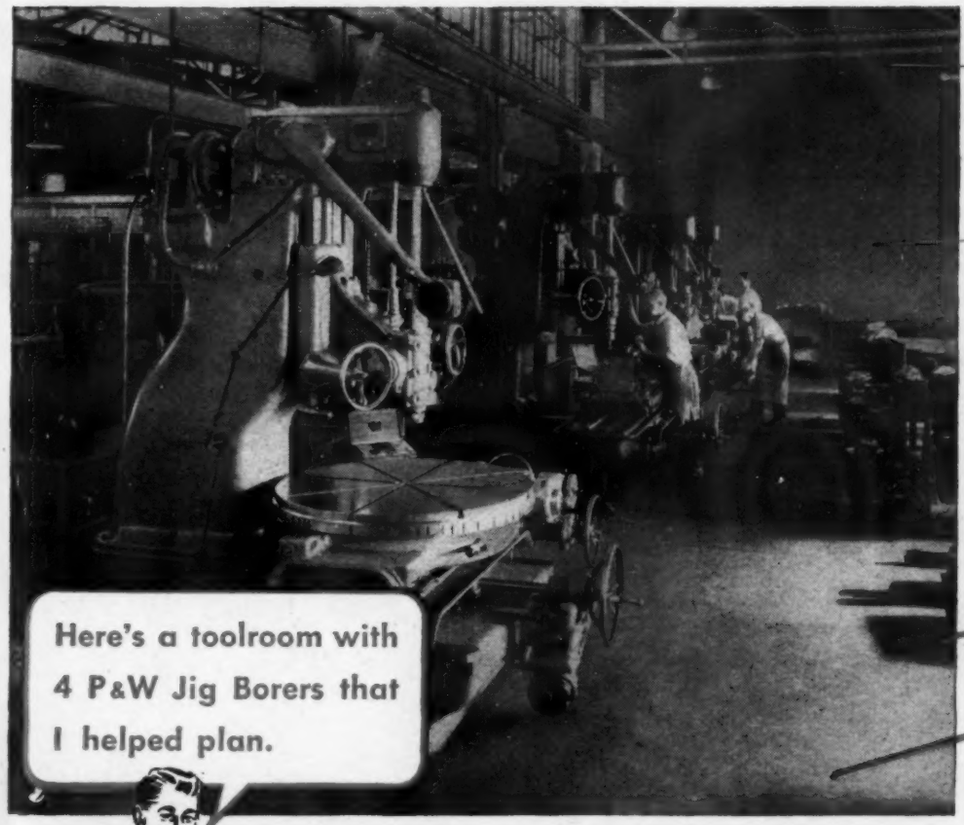
Bring the P&W Engineer into your Toolroom Picture

Labor's up! Material's up! Competition looms on both price and quality. Manufacturing survival and jobs depend on meeting it. What to do? Here's one thing . . .

Bring your Pratt & Whitney Engineer into the picture. As a starter, let him survey your toolroom set up. That's one good place to look for cost-cutting chances. He'll know how to find them. He's thorough.

He'll study the complete layout. Materials, methods, requirements and equipment will have his close scrutiny. He'll check them all against known standards. Then, he'll report to you with recommendations for any action that will result in higher efficiency and lower cost. And his services are yours for the asking, without obligation.

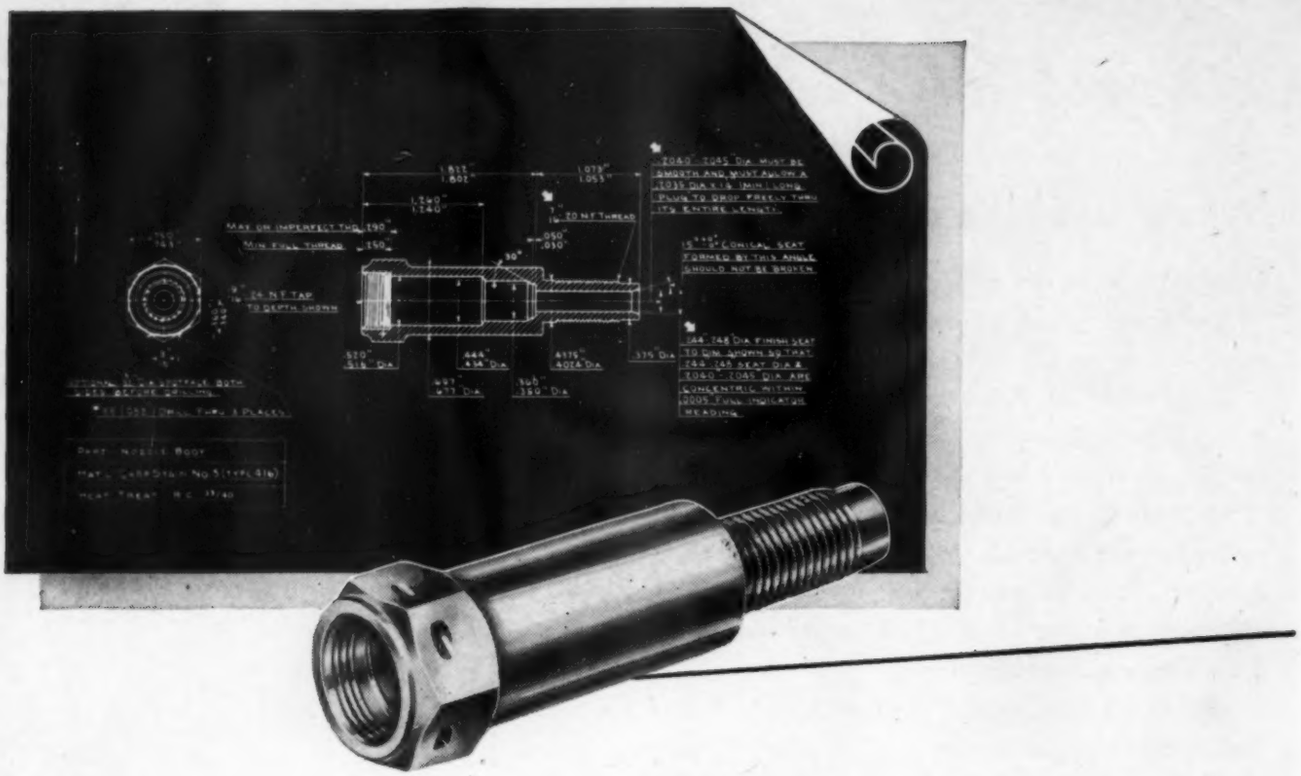
Write us a letter now, while you think of it, and also ask for your P&W Condensed Catalogue.



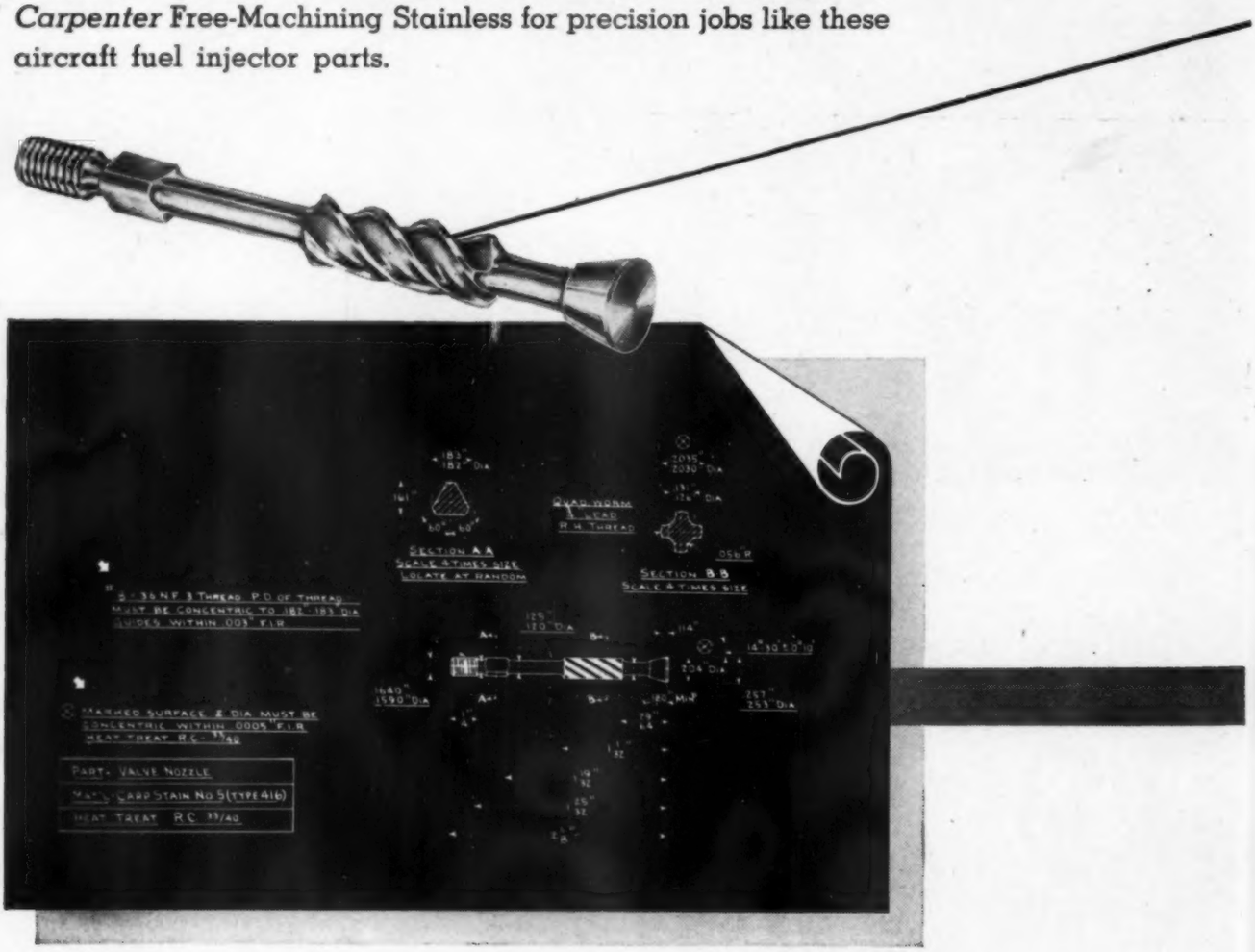
PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT



You really begin to cut machining costs when your orders specify *Carpenter* Free-Machining Stainless for precision jobs like these aircraft fuel injector parts.

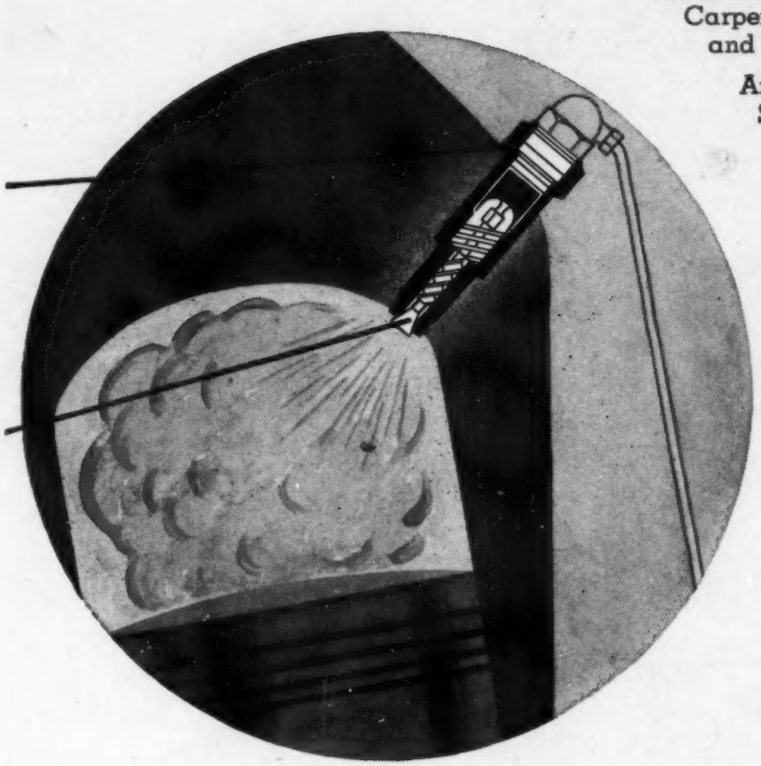


How to Get the Most from Stainless
and Reduce Your Unit Costs!

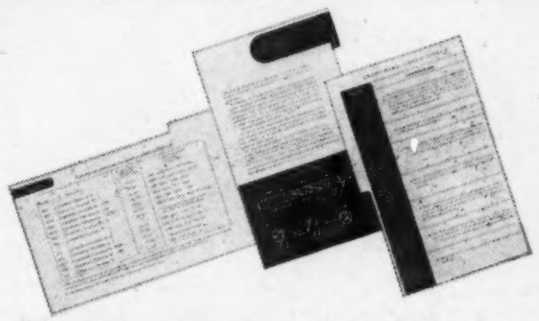
Right now when you are looking for new ways to cut costs, take a look at your Stainless fabricating picture. For true economy, you need the right analysis of Stainless Steel for the job.

But *more* than that, you need a Stainless that is so uniform from lot to lot that you can rely upon it to respond to the same machining methods *every* time. That's why cost-minded designers and production men prefer Carpenter Stainless. Its uniformity—saves time and trouble—keeps down rejects.

Another big advantage of using Carpenter Stainless is the Carpenter experience you get along with it. Personal help and cooperation from your Carpenter representative, plus helpful printed information make it easy to get the most out of these Stainless Steels. For fast delivery on Stainless bars, call your nearby Carpenter warehouse.



Here's the First Step to Lower Costs on Stainless Jobs



Your Carpenter representative has copies of this cost-reducing information available for management and production executives. The 96-page "Notebook on Machining Stainless Steels" will help you discover new ways to reduce your unit costs on Stainless jobs. Extra copies of this valuable book can also be supplied as a guide to the men in your shop, at 50¢ per copy. Write us, on your company letterhead, please.

THE CARPENTER STEEL COMPANY · 109 W. BERN STREET, READING, PA.

Carpenter

FREE-MACHINING

STAINLESS STEELS

more than corrosion resistance

PROMPT SHIPMENT FROM CONVENIENTLY LOCATED STOCKS

Buffalo	Cleveland	Hartford	Philadelphia
Chicago	Dayton	Indianapolis	Providence
Cincinnati	Detroit	New York	St. Louis

SEE THE CLASSIFIED SECTION OF YOUR TELEPHONE DIRECTORY

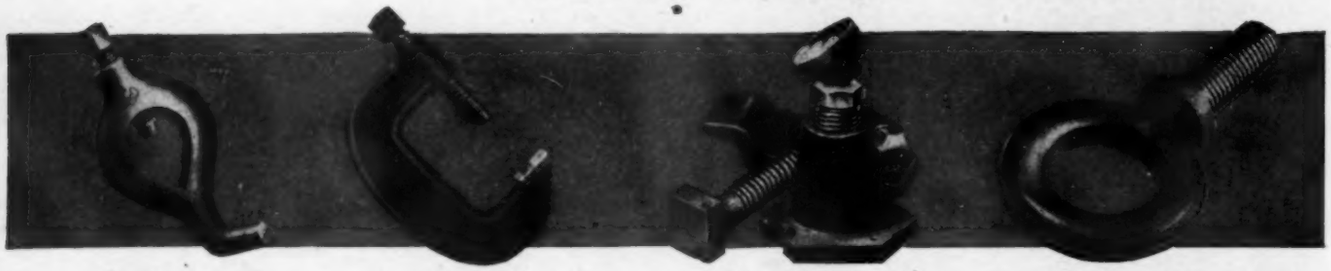
ARMSTRONG

Quality TOOLS

ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits... Ground Cutters.
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades.

ARMSTRONG Turret Lathe and Screw Machine TOOL HOLDERS
Drill Holders, Cutter Holders, Finishing and Knurling Tools for standard operations.



ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also Machinists' Clamps.

ARMSTRONG Setting Up Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.

ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating ... stronger.

ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

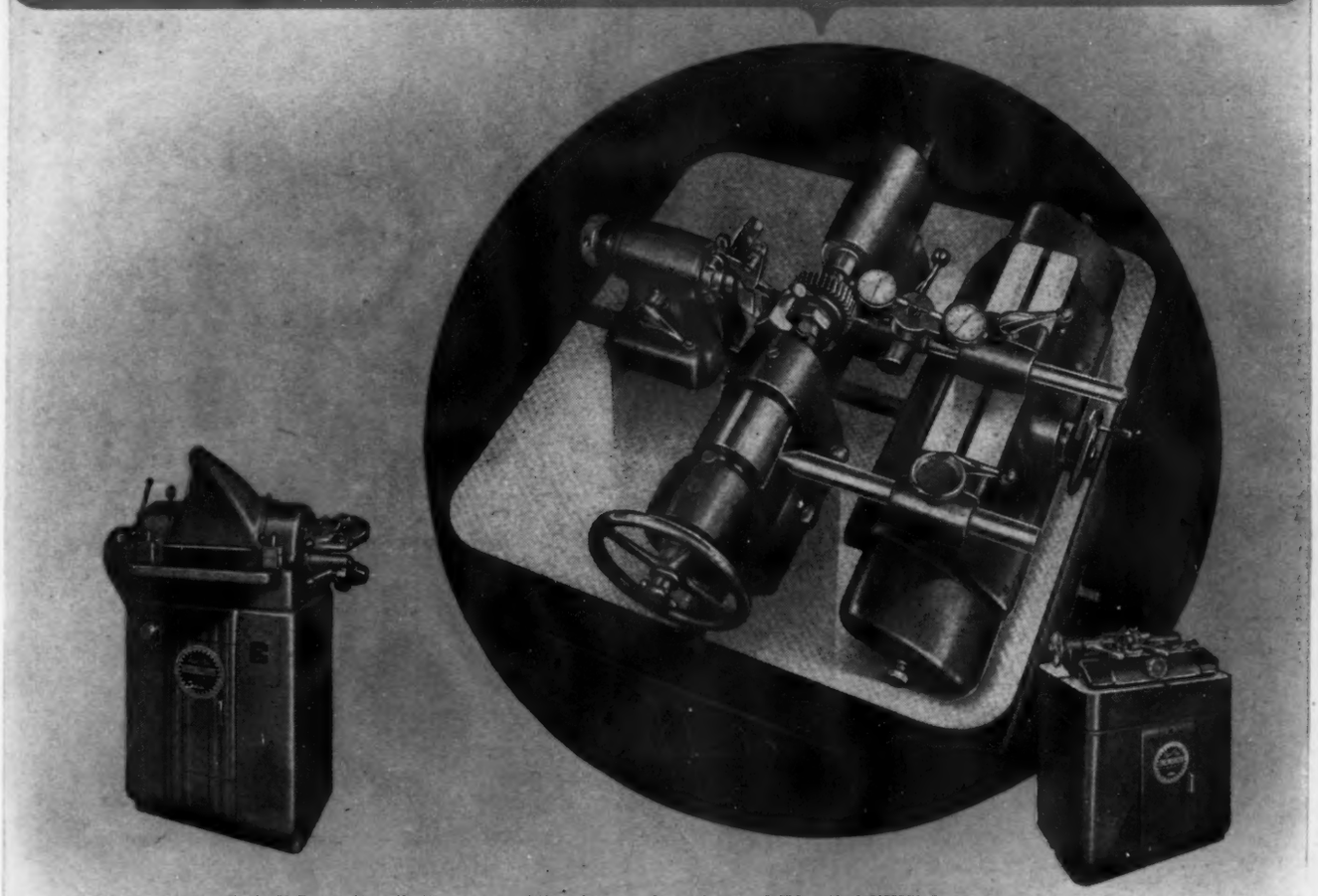
ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vices.

ARMSTRONG BROS.

Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
N. FRANCISCO AVE. CHICAGO 12. U.S.A.
Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, Calif.

FIRST MEASURE YOUR GEAR ERRORS AND GEAR NOISE THEN CORRECT THEM



If you know how much of an error you have in index, helical angle, lead, parallelism, tooth size, eccentricity or interference, you can determine what must be done to correct it.

If there is apt to be objectionable noises in a gear train, find out before those gears are assembled just how much noise they will make in operation. Then you can take the necessary steps to correct for noise without paying unnecessarily for both assembly and disassembly.

The Red Ring Universal Gear Checker and Gear Sound Tester will permit you to accurately evaluate gear errors and gear noises. The Sound Tester will, by the character of the sound produced, indicate its cause.

Write for descriptive folders on these machines.

2525

RED RING PRODUCTS

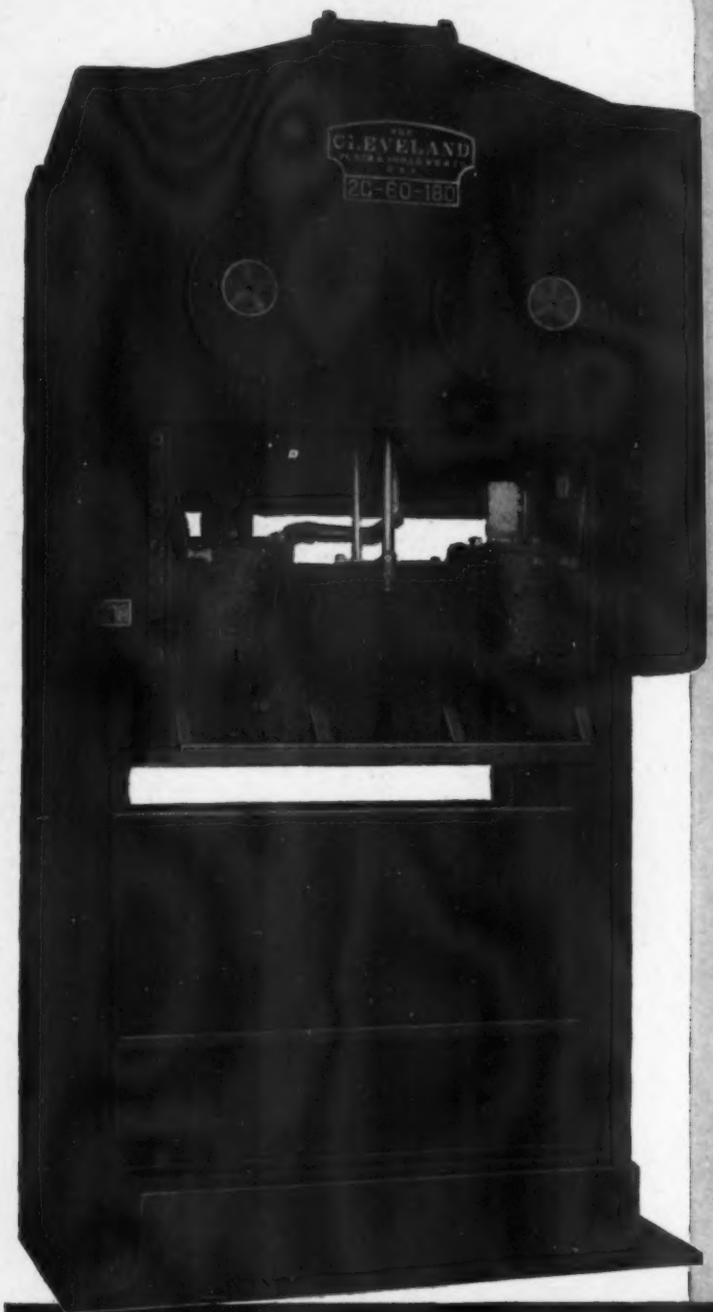
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE • ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

CLEVELAND

Two Point Open Back GAP PRESS



Modern Presses PAY FOR THEMSELVES!

In accuracy, in increased production, in the quality of the work they produce and in economy of operation.

Progressive manufacturers recognize this fact and take advantage of every opportunity to reduce costs and better their production facilities by installing Presses that represent a great many advances in efficiency, economy and precision.

This Cleveland Double Crank Gap Press is typical of the improvement in design and construction of this particular line, developed by Cleveland Engineers.

The enclosure of the gearing and drive unit within the Crown and the elimination of all outboard brackets and other projections not only contributes to the rigidity of the Press but also makes Cleveland Presses exceptionally convenient for loading and unloading dies and provides a greater measure of safety for the operator.

The Press is equipped with an electrically controlled friction clutch which is instantaneous and positive in action and under the instant control of the operator at any point of the stroke.

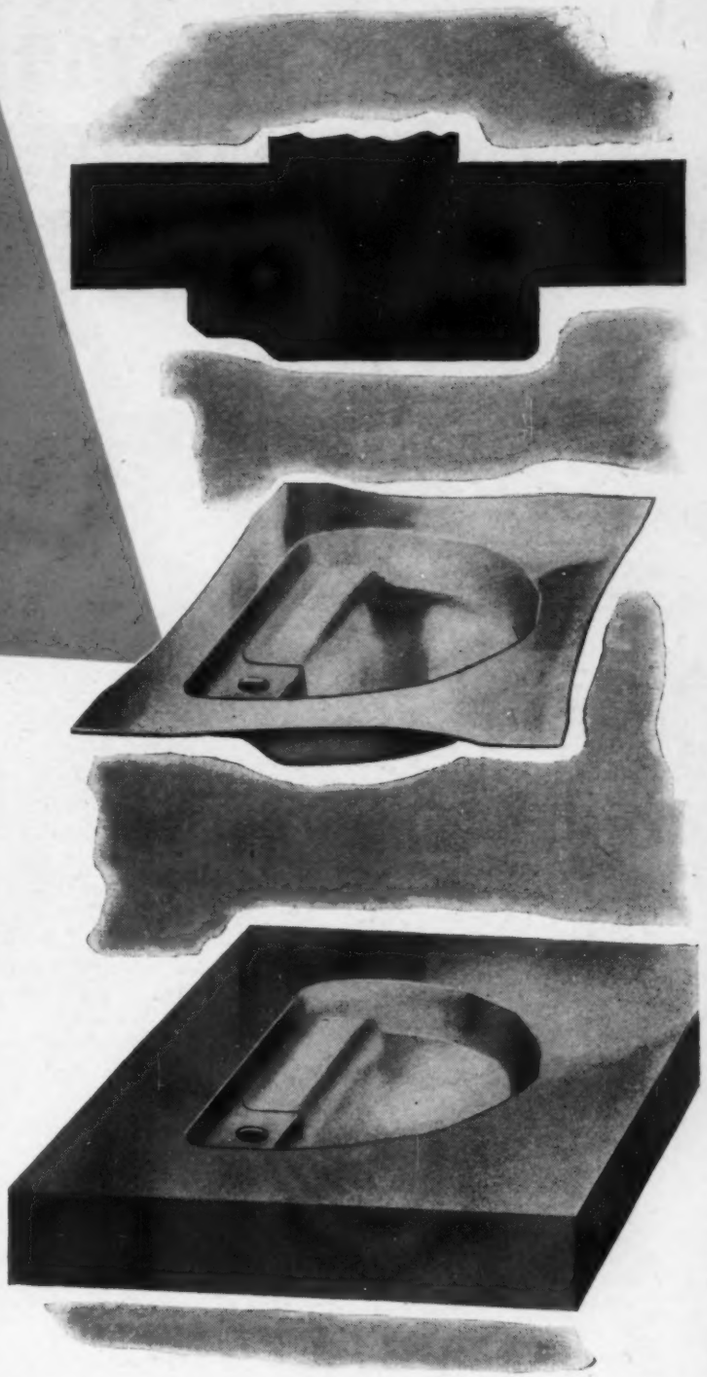
While the Cleveland 2G-60-180 illustrated has a 12" stroke; 4" adjustment; 22" x 54" slide area and a capacity of 180 tons, this type of Press can be furnished in sizes and capacities to suit requirements, with standard bed or with cut back bed. (as illustrated).

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY
CLEVELAND 14. . . . . OHIO

— DISTRICT OFFICES —
NEW YORK — CHICAGO — DETROIT
PITTSBURGH — PHILADELPHIA

These Modern CLEVELAND Open Back Gap Presses Can Also Be Furnished With Standard Bed (Without Lower Section Being Cut Back)

HOT FORMED
CAN MEAN
ONE DRAW



WITH A BONUS IN LIGHTNESS!

If you have been deep drawing other metals, you may be accustomed to making two or three draws to accomplish the desired reduction, often with anneals between draws.

With American Magnesium, high reduction can be obtained in a single draw at elevated temperature. Intermediate draw tools and annealing are eliminated.

With drawing time and costs cut appreciably, American Magnesium may show you substantial savings in drawn products. In addition, your products enjoy a *bonus* in lightness—for magnesium is 35% lighter than aluminum; 75% lighter than steel!

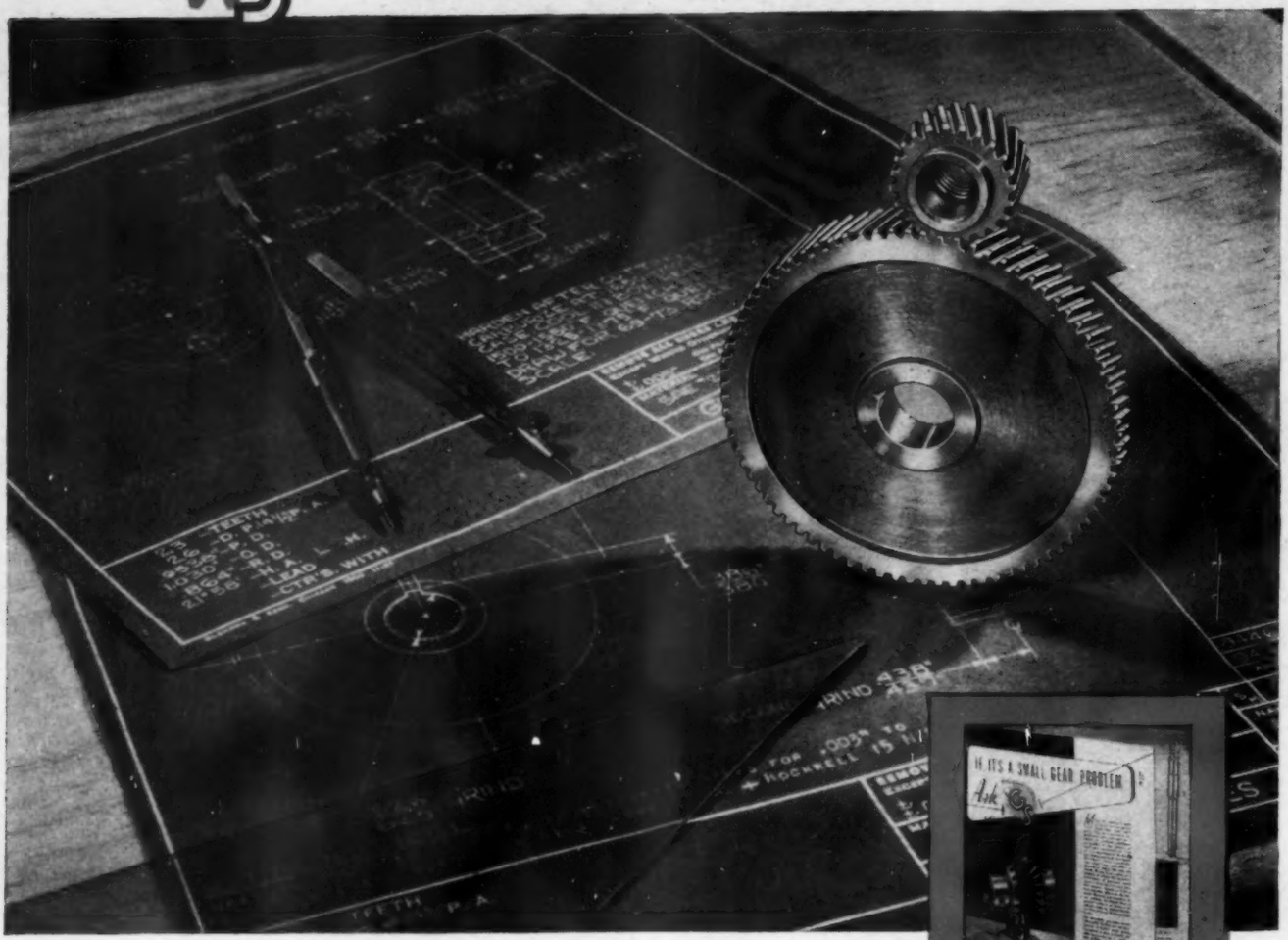
And when you specify American Magnesium, you also gain the advantage of Aluminum Company of America's 59 years of light-metal know-how, to help you use magnesium profitably in those places where it should be used. Write for "Deep Drawing Magnesium Alloy Sheets", or call your nearest Alcoa sales office. Aluminum Company of America, sales agent for American Magnesium products, 1709 Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO Reg. U.S. Pat. Off. PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

WHY YOU SHOULD LET G-S MAKE *YOUR* SMALL GEARS



SMOOTHER, better performance and longer life characterize the Small Gears we make. They give *added dependability* to the devices in which they are used. The superior advantages of G-S Small Gears are the result of more than a quarter century of specialization . . years of developing men, materials and machinery to their present high degree of efficiency. Here, the best possible solutions to your small gear problems can be determined by our skilled engineers. Specifications and production procedures, however exacting, will be established and carried out quickly and at moderate cost. Discuss your needs with a G-S Small Gear Specialist. Get suggestions, ideas, and cost estimates. This friendly service doesn't obligate you at all.

The G-S Catalog Bulletin describes many different types and applications of G-S Small Gears. Please ask for a copy on company stationery.

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

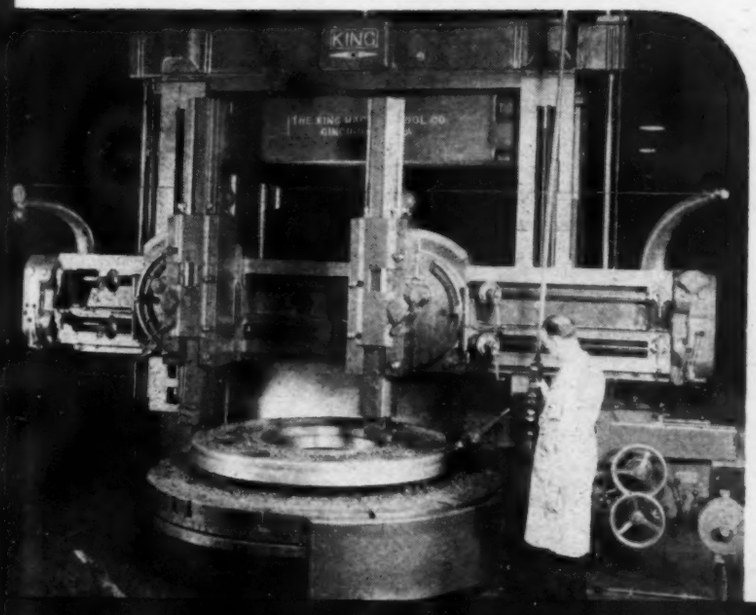
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

3 Heads OPERATING AT ONCE

KING

New Series

VERTICAL BORING & TURNING MACHINES



● Boring - turning - facing simultaneously with 3 heads in operation at once is indicative of the rigidity and smooth power provided in the new series King Vertical Boring Machine.

The job shown is a 74" diameter feed worm wheel being machined for a prominent machine tool builder.

On work where carbide tools can be used most efficiently and economically this new series King offers several advantages. New rectangular type rams — saddle for ram head square locked and fitted with four tapered gibs for adjustment — a heavy tie plate across the swivel are points in construction that assure greater rigidity and accuracy.

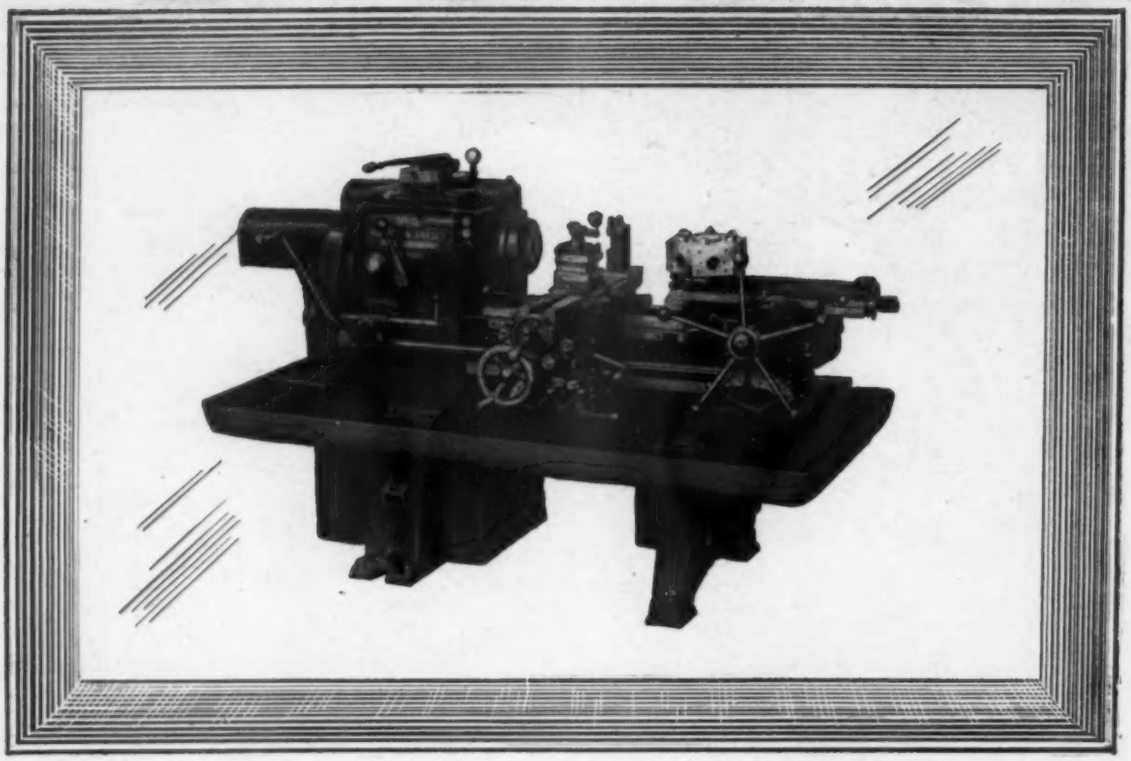
For long service—low maintenance, investigate the new King.

Available in 10 sizes: Single column 30", 36", 42". Double column 52", 62", 72", 84", 100", 120", 144".

THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

Builders of Vertical Boring and Turning Machines Exclusively



Portrait of an expert in employee relations

BETTER PAY FOR WORKERS, shorter hours, easier work—and more and better things at lower prices for the public—are all possible by the efficient use of modern machine tools. *And they are NOT possible in any other way.*

Modern machine tools are easier for workmen to use, and produce better products. Because of new improvements and greater power, these tools, *efficiently used,* produce more. Out of this greater production a workman, even in shorter hours, can be paid more and *still* produce at a lower cost per piece.

These lower costs can mean lower prices for the public. Lower prices can mean more sales and a more profitable operation, and that makes the workman's job more secure.

But note that *two* things are necessary:

1. The modern tools. That's up to management.

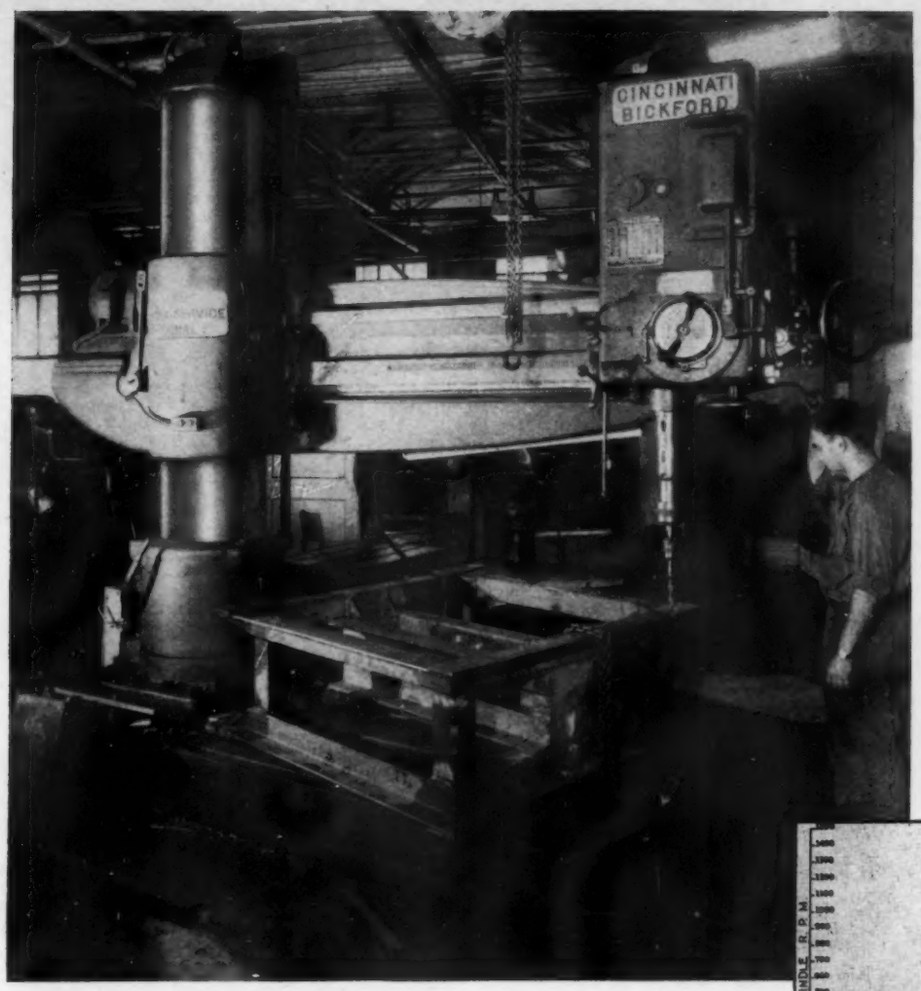
2. Their efficient use. That's up to workmen.

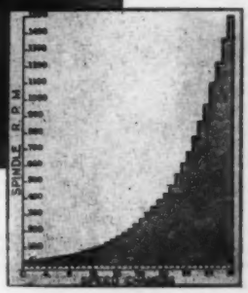
The tools are ready. If people went to work and used them properly, instead of all this talk about easy-roads-to-riches-without-work, we would have no inflation, no shortages; we *would* have good jobs at good pay; we would have prosperity and peace.

WARNER & SWASEY
Machine Tools
Cleveland

You can machine it better, faster, for less... with a Warner & Swasey

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING & THREADING MACHINES





36 speeds—no gaps or duplication—with only 17 gears.

THE SPEEDS AND FEEDS YOU NEED FOR THE JOB

FEED IN THOUSANDTHS AND THREADS PER INCH
DOTTED LINE INDICATES NEUTRAL AND HAND FEED POSITION

POSITION OF FEED CHANGE LEVER									BACK GEAR LEVER
1	2	3	4	5	6	7	8	9	
25	21	17	14	12	10	8½	7	6	→
[illegible]	103	[illegible]	[illegible]	59	50	42	35	29	←

- *18 rates of power feeds from .006" to .125" per revolution include standard tap leads.*

Equal Efficiency of Every Unit Makes the Balanced Machine

Twelve three-quarter-inch holes are being drilled and tapped at a 75% saving over a former method.

This Cincinnati Bickford Super Service Radial Drill is called upon to do a great variety of small lot jobs in this shop.

The range of feeds and speeds and the extreme ease of handling have made this versatile drill very profitable.

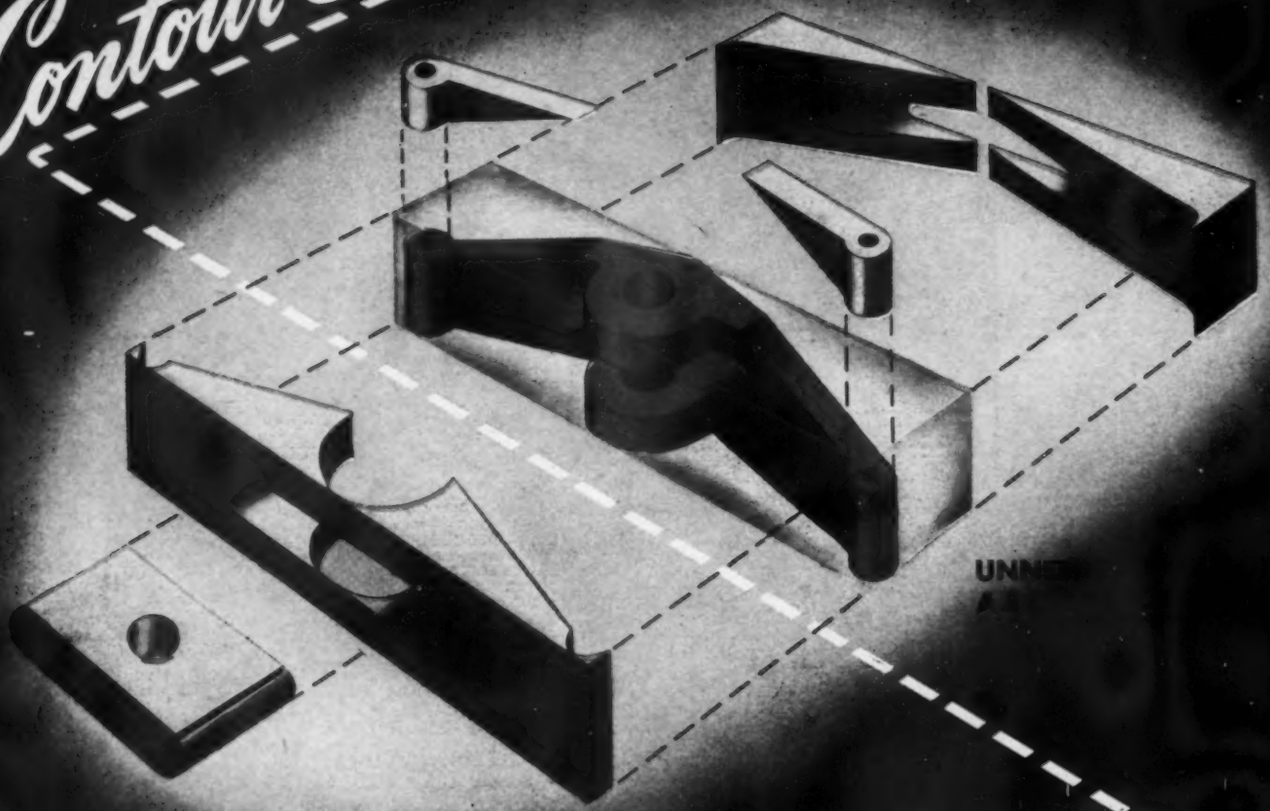
Write for detailed Bulletin R-24A.

See our condensed catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Contour Sawing



The DoALL Company

DES PLAINES, ILLINOIS

DoALL STORES IN KEY CITIES

American Machinist's Spot NEWS OF METALWORKING

Two important car manufacturers in the so-called medium-priced class are preparing V-eight engines for use in 1949 models. Tooling programs for the new engines are now being developed. Both companies heretofore have adhered to the "in-line" principle. Contemplated shift is partly to get higher compression ratios and to use very high octane gas.

Looking for heavy equipment, including machine tools, Britain and France found at Leipzig Fair that deliveries were a year away and that German firms, mostly from Soviet zone, refused to accept francs. Nevertheless Britain placed some machine tool and textile machinery orders. Most of output of German exhibitors' plants is being taken by Soviet in payment of reparations.

UAW-CIO explains current special assessment of members as follows: In May, 1945, union had $2,185,383 in cash, bank deposits and government bonds. A year later, after General Motors strike, total had shrunk to $158,800. Last November union's strike fund was only $124,080. It needs bolstering, hence the assessment. Union has 700,000 members, as against 1,080,666 in May, 1945.

British will hold machine tool show at Olympia, London, August 26-September 11, 1948. U. S. machines can be shown only through British agents, should be shipped at least three months ahead.

International Harvester's price cuts are reported not large enough to compel other farm implement makers to take similar action. Implicit in Harvester's decision is belief that labor negotiations will not result in severe wage increases and that suppliers of component parts will not raise prices. All I. H. lines except refrigeration have been cut.

Norway has been granted $50 million loan by Export-Import Bank, payable in 36 semi-annual installments beginning June 30, 1949, at 3% interest. Some $6 million will be spent for machines and machinery and $12 million for iron and steel products. Purchases will be made largely by private importers.

A peacetime WPB, named the National Security Resources Board, will take over the task of industrial mobilization now in hands of Army-Navy Munitions Board, under legislation asked of Congress by President Truman. Munitions Board would be restricted to planning for military phases of industrial mobilization. In wartime, NBRD would expand into roles filled during last war by WPB, OPA and WMC. Strategic relocation of industry is one of NBRD jobs.

Foundry experts are developing castings in two pieces, an inner and outer section, which are silver soldered together, in place of complicated one-piece castings with precise open spaces between the two walls around the circumference. The new developments will be applied to automobile cylinder block castings.

Sweden's metalworking industries are booming. Shipyards and electrical machinery plants have backlogs for 32 months and 25 months respectively. Automobile factories are booked ahead for nine months. Labor shortage is critical, particularly among women.

Springfield, Mass., Armory has set up a conveyorized assembly line to process and "can" Garand rifles for a future emergency. Each can will contain 25 rifles. Millions will be stored, all in firing condition. War surplus materials-handling equipment was engineered to do the job.

Several companies are preparing to make such products as electric razor components, brass belt buckles and drill chuck jaws in pressed powder form. Production men see distinct field opening up between casting and forging practices, with measurable lowering of component costs.

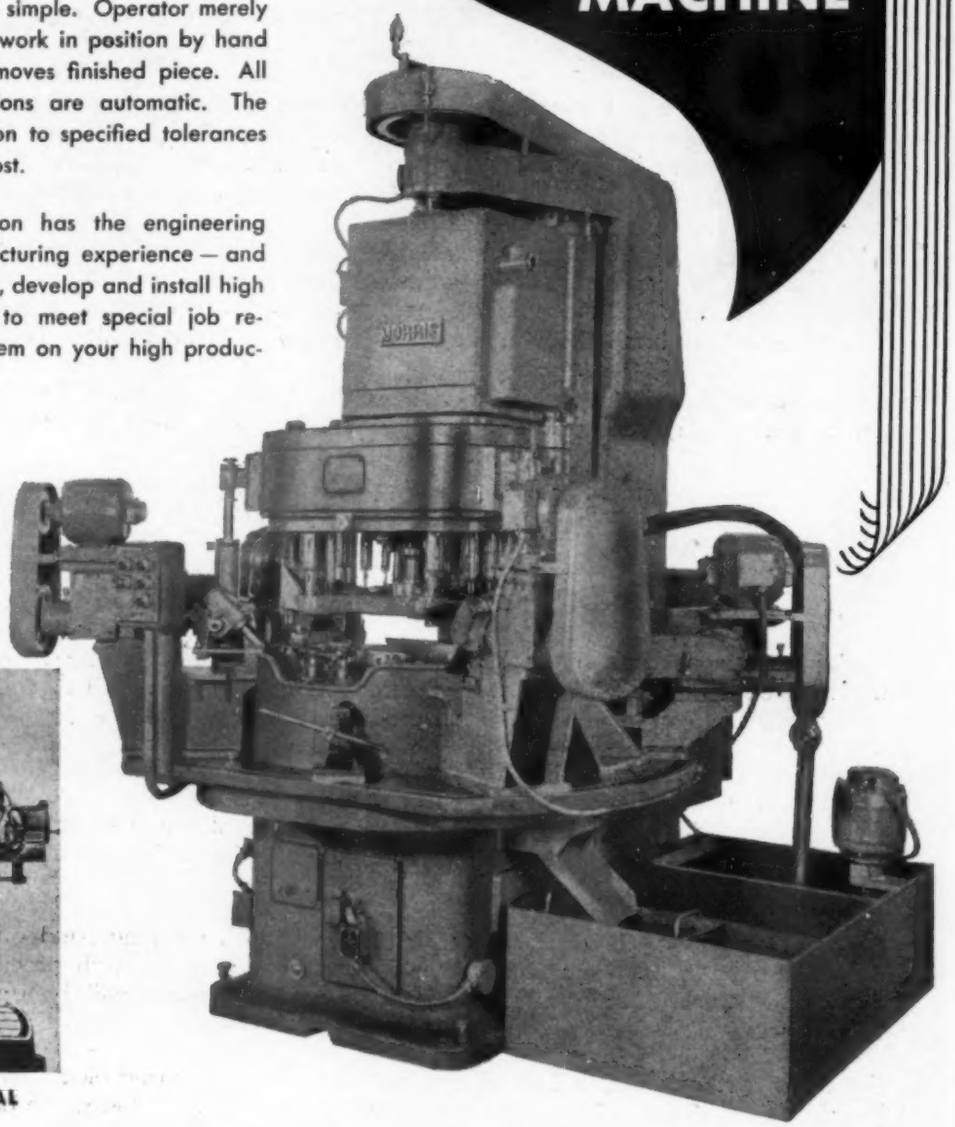
MORRIS
MOR-SPEED *Six-Station* Vertical Hydraulic MACHINE

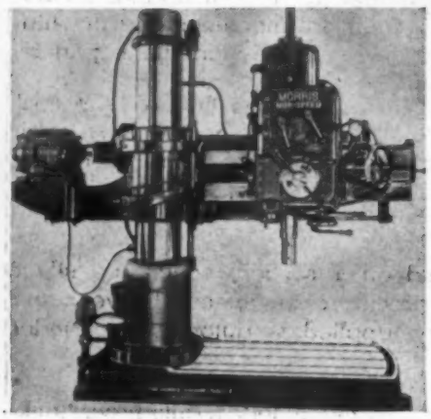
● Illustrated is a Morris high production machine of Vertical design with hydraulic automatically operated indexing fixtures.

The operations consist of drilling, reaming, counterboring, countersinking and chamfering holes in various positions in Refrigerator Compression Cylinder parts. There are thirty-one vertical spindles driven by a hydraulic unit and eight horizontal spindles rack fed from hydraulic unit.

Operation is extremely simple. Operator merely loads and clamps the work in position by hand and unclamps and removes finished piece. All other operating functions are automatic. The result is high production to specified tolerances at exceptionally low cost.

The Morris organization has the engineering "know how" — manufacturing experience — and shop facilities to design, develop and install high production equipment to meet special job requirements. Consult them on your high production jobs.





MORRIS MOR-SPEED RADIAL

Builders of MOR-SPEED Radials

The MORRIS *Machine Tool Co.*

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

A Realistic Surplus Program

The government's surplus machine tool situation demands drastic action. Unless such action is forthcoming soon, the disposal problem is likely to end in a hopeless mess.

The facts are these: Of the total number of machines already declared surplus or yet to be declared, only about one-fourth have been sold by War Assets Administration.

Yet inquiry among big users of machine tools reveals that they have bought almost all the surplus units which they intend to purchase. The truth is that a year ago they had acquired 80% or more of the machines they wanted from surplus.

The big users comprise the best market for surplus as well as new machines. Small users from now on will be the main source of sales. But small shops cannot in a generation absorb all the machines which the government would like to sell.

Surplus sales are not going too well. WAA has a large staff and the selling cost is high, especially when expense of transporation and storage is considered.

Though no figures are available, there is a strong suspicion that from now on each WAA sale of a surplus machine will cost the taxpayer money.

Moreover, word has got round that government red tape makes it hard for a prospective buyer to get what he wants. Prospective customers are discouraged by the effort required to ferret out what they want and by the possibility that they never will find exactly what they are searching for.

At the current rate of sales, surplus machines will be overhanging the market for several years at a minimum. Meanwhile sales of surplus general-purpose machines are injuring sales of new machines.

WAA, under the circumstances, should do whatever is necessary to wind up surplus disposal as quickly as possible.

We propose a four-point program which should aid in liquidating surpluses speedily:

1. Remove priorities which have hamstrung WAA's sales. "Politicking" was the only excuse for Congress to impose priorities at all. It is time to remove politics from an economic situation.

2. Set aside a very large reserve for a national emergency. It would be nothing short of criminal negligence on the part of our national authorities to do otherwise. With the world a tinder box this is no time to dissipate valuable national resources.

3. Give all public educational institutions a chance to acquire machine tools at a nominal price of $1 each. Heretofore all efforts to put such a policy into effect have failed. With school funds what they are and with teachers in need of higher salaries, what chance is there to modernize school shops unless surpluses are made available for that purpose?

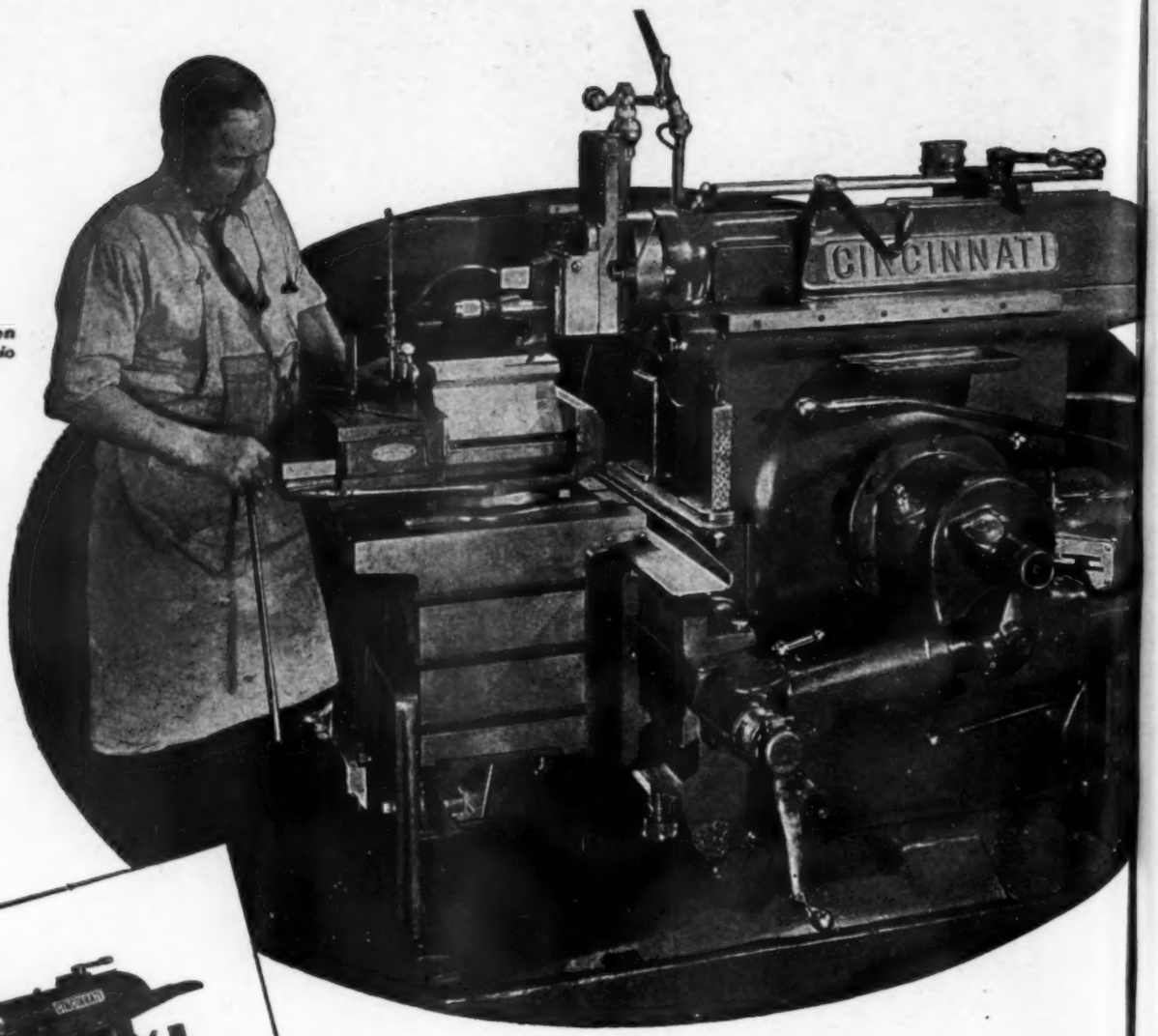
4. Adopt a liberal scrapping policy. Up to this time WAA has given lip service to a scrapping program, but little has been done to implement it. Officials have hesitated to junk even the oldest machines. The government should realize that tens of thousands of machines will never be sold at more than the scrap price. So far as the national economy is concerned, it would be a sensible procedure to scrap these machines which nobody wants.

If these four recommendations should be put into effect, the government would be well on its way toward an orderly and quick liquidation of the surplus problem.

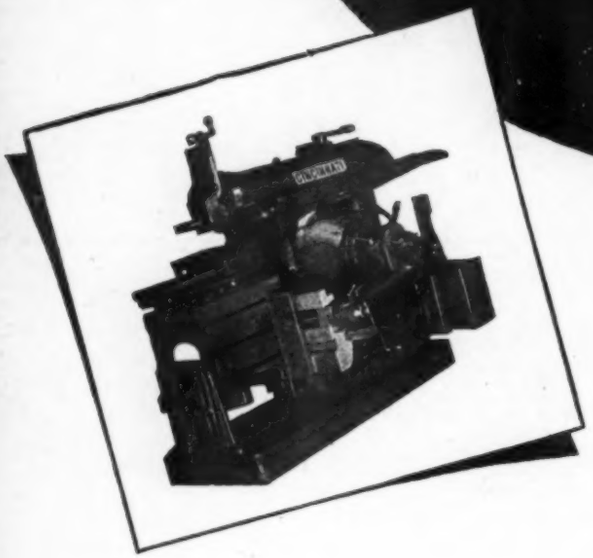
Burnham Finney

EDITOR

ACCURACY FIRST...



Courtesy of
The Sheffield Corporation
Dayton, Ohio



Accuracy is the first requirement where fine tools and gauges are built—their whole value lies in their accuracy.

In their production fine machines are needed for only fine machines can produce fine tools.

Cincinnati Shapers are found where jobs are most exacting—they are built to close tolerances, have reserve power and rigidity, and their smooth performance meets the demand for accuracy.

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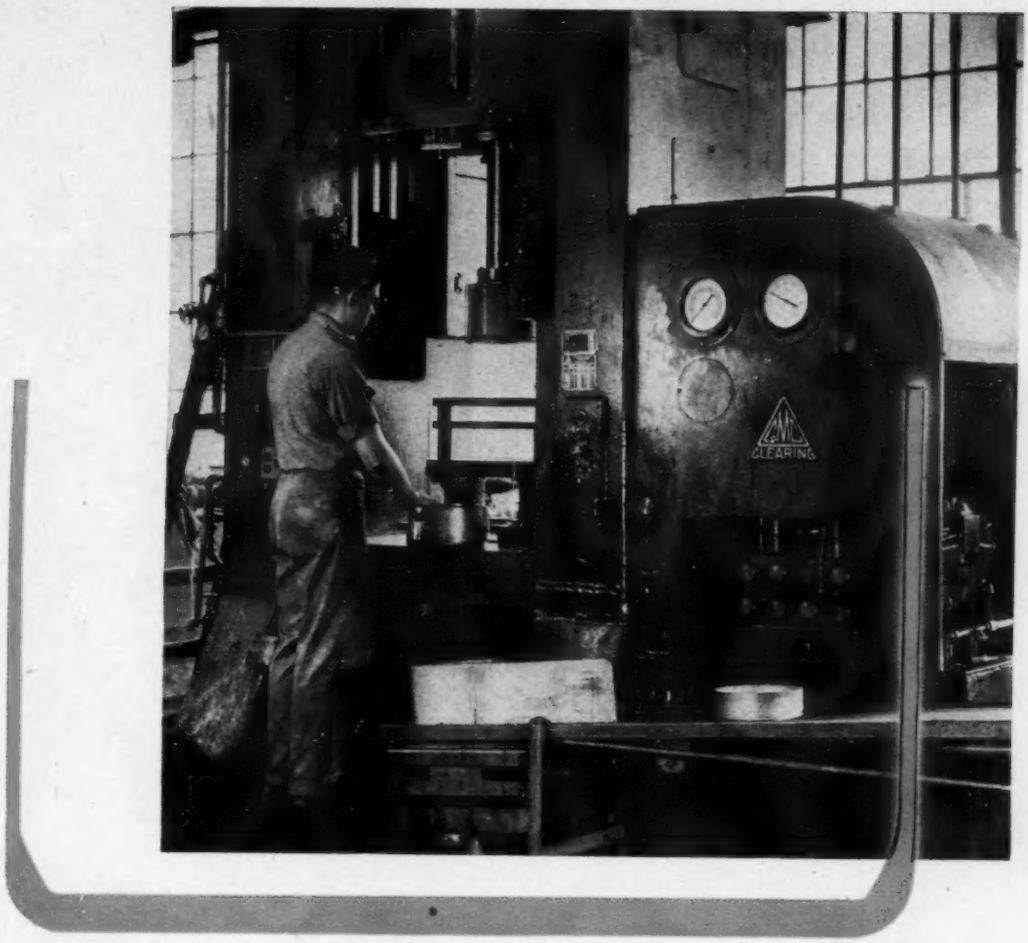


The job, after its first draw, is conveyed by belt to this fully automatic hydraulic press for the first of three ironing operations. Two draw rings are used in one setup to give two ironing stages

Tool Design Streamlines Drawing Practice

BY G. W. BIRDSALL, REYNOLDS METALS COMPANY

Aluminum utensils with triple-thick bottoms require a heavy ironing and unique bulging die design . . . Sidewall hardness is doubled by three ironing steps

DEEP DRAWING of conventional aluminum kitchen ware is not ordinarily difficult. However, a recent line of Reynolds "Lifetime" kitchen utensils produced at the La Grange, Ill., plant, Housewares Division of Reynolds Metals, features a triple-thick bottom for added uniformity and for "waterless" cooking. The unusually heavy ironing necessary to get the walls down to one-third the thickness of the bottom increases density of sidewall metal and more than doubles the Brinell hardness.

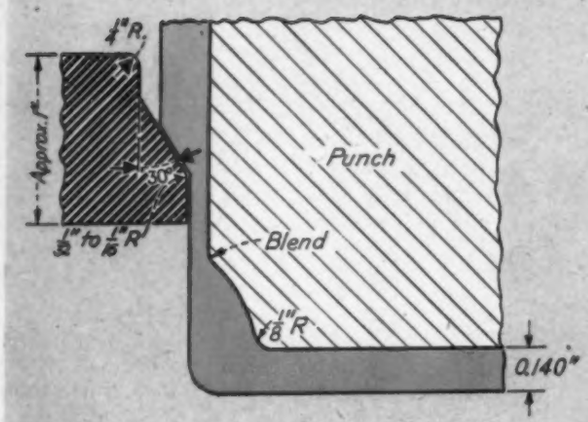
Design of the utensil employs an outside shoulder on the sides near the bottom and the extra metal from the inside must be shifted to the outside of the piece by an unusual bulging die. Special flanging operations are also required in making the water seal cover.

The blanks of 3S aluminum, are 10½ in. in dia. by 0.140 in. thick and run through roller-oilers before press operation to coat a drawing compound on both sides.

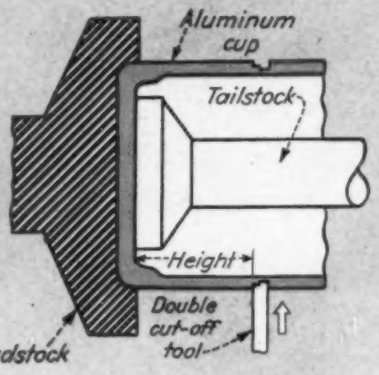
The first operation, on a double-acting 150-ton Bliss press at 500 rpm., forms a shell about 2½ in. deep and 7 in. in dia. At the bottom of the stroke, the ram presses a die against the bottom of the cup to stamp the Reynolds "Lifetime" trademark.

The work is oiled again, on the outside only, using an oil of SAE30 viscosity. A belt conveyor carries the parts to the second press where the heavy ironing of the side walls takes place. This unit, a 100-ton Clearing hydraulic press, is operated at a ram speed of about 52 in. per min., and is completely automatic in cycle.

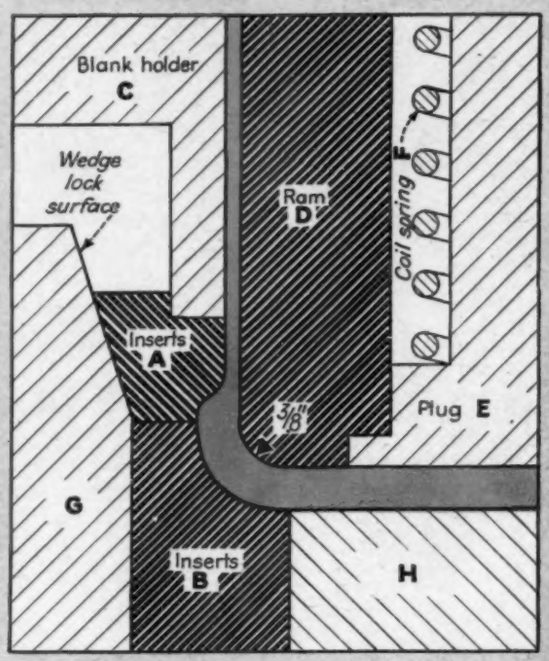
Reduction of the section from the heavy bottom to the thin side walls is usually done in three stages. In the first stage, the wall thickness is reduced from 0.140 in. to 0.100 in., a 0.040 in. reduction. In the second stage, wall thickness is reduced another 0.040 in. to 0.060 in. The



IRONING . . . The first stage of ironing gives a partial reduction in sidewall, and the radius blending the inward taper and vertical section of the draw ring is extremely critical. The punch supports the work



CUTOFF . . . A special tailstock and headstock setup adequately supports the utensil for the cutoff operation, roughing and finishing being accomplished in one pass



BULGING . . . In this bulging-die setup the blankholder actuates the hardened steel insert "A" which on the downward stroke forms the cavity ("A" "B"), into which the displaced metal flows to form the distinctive outer shoulder. Metal is prevented from flowing into the bottom of the pan by a spring-pressure plug

third stage is a 0.020 in. reduction to leave walls 0.040 in. thick.

During these operations, wall height has been increased from 2½ in. to approximately 5⅝ in. and the I.D. has been maintained at the original 7 in. All the work has gone into thinning the walls and increasing their height.

Metal Distribution

In the press setup for handling this heavy ironing, the cup is pushed down through ring dies that work the metal in the sidewalls. Originally the three stages were handled separately, but experimental work has been done in handling two of the stages simultaneously by placing a second draw-ring die a few inches below the first so the ram, in a single downward stroke, pushes the cup through two rings.

This double operation caused the work to overheat, which was compensated by water-cooling the punch or mandrel to conduct heat away quickly from the work at the point where it generated. The lower temperature also helps prevent galling.

There are two critical points in design of the ring die—the inward taper angle and the radius at the bottom of the surface where the taper meets the vertical portion of the die ring contacting the work. An inward taper angle of 30° has been found best for this work. The radius blending this surface into the vertical is between 1/32 and 1/16 in. and is extremely critical. If the radius is too small, the metal will not flow smoothly past this point and uneven ram action produces chatter marks. On the other hand, too large a radius here causes the shell to break. There is no way to predetermine exactly the radius to use—it is largely a matter of trial and error.

At the corner of the shell a considerable amount of metal in the sidewall has been allowed to flow into a cut-away portion of the punch at the corner. This is done in order to accumulate metal which later can be "bulged" out to form the distinctive outer shoulder that identifies these triple-thick bottoms.

When more than one draw ring is utilized, oil is introduced between them by a wiper ring arrangement that applies the drawing lubricant to the work as it is pushed down toward the second draw ring. The wiper ring is located directly below the first draw ring.

Die Maintenance

This heavy ironing of the sidewalls must be done without leaving any die or draw marks because these surfaces must subsequently take a high polish. Work must be kept clean and all drawing lubricants are carefully prepared, handled and applied to prevent any dirt from becoming mixed in with them.

Some die steels show a tendency to pick up aluminum and mar the surface of subsequent work going

through the die. Most marking of work has been traced to die pickup of aluminum, rather than to scoring of the die rings themselves. Oil-hardening die steels have shown a minimum aluminum pickup.

Dies polished to a high luster help prevent metal pickup and marking, and polishing should be in the direction of metal flow. A good grade of oil-base drawing compound helps keep pickup at a minimum.

After ironing, the shells are clamped in a spinning lathe and a double cut-off tool takes a double cut on the top of the sidewalls to eliminate any burr kicked up in the rough cut. The tool is moved radially into the side of the shell, which is turned at 1200 rpm., cutting the overall height of 5¼ in. The sidewall height is critical because subsequent spinning and forming operations must produce a tight seal for the cover.

Shells are cleaned before bulging by wiping each piece individually with a cloth soaked in a cleaning solution, followed by a dry cloth, and are then oiled. In bulging, the extra metal retained at the corners during ironing is moved outward radially to leave a smooth inner contour.

As shown, the bulging dies are in the closed position and all the metal allowed to remain at the corner during ironing has now been forced outward to produce the shoulder that identifies the triple-thick bottom. At the same time, the outline of the inner surface has been given a smooth conventional contour for easy cleaning.

The base or stationary portion of the bulging die is made up of three principal sections—*G*, *H* hardened steel inserts at *B* on an accompanying sketch. When the double-acting press is closed, the blank holder comes down first, carrying with it the series of *"A"* inserts. These contact the sloping surface of *"G"* to form a positive wedge-lock. Inserts *A* and *B* now complete the die cavity into which the aluminum at the corner is forced by the downward movement of the ram.

The plug *E* protrudes about ⅛ in. from the end of the ram or punch to contact the pan bottom and hold it flat under a pressure of about 200 tons during the actual bulging. This pressure is produced by a heavy coil spring at *F* about 8 in. long, wound from ½-in. dia. wire, and prevents the metal in the corner from flowing back and distorting the bottom of the pan.

Another critical element is designing the cavity formed by the *A* and *B* inserts to precisely fit the amount of metal available. Excess metal is extruded as flash at the parting line of the dies while insufficient metal gives an uneven and unsightly shoulder. The amount of metal retained in the cutaway corner of the punch in ironing must match the metal required to just fill the bulging die cavity and provide smooth contour.

Hardened steel inserts are used not only at points *A* and *B* but also at the lower corner of the ram at the ⅜-in. radius to take any wear and are easily replaced when they no longer meet dimensional tolerances.

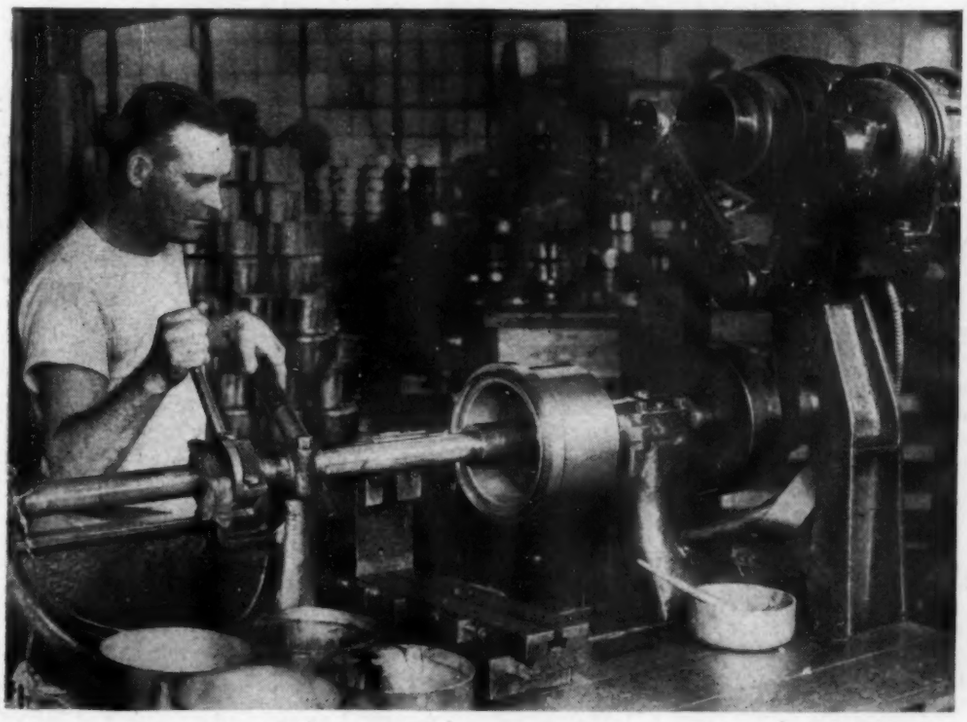
Wedge Lock

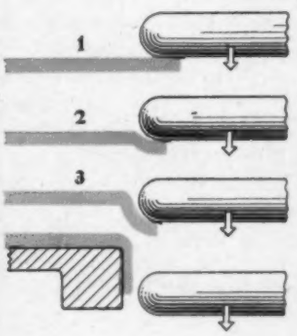
The sloping surface of the *A* inserts, held down solidly against the conical contacting surface on *G*, provides a positive support to the *A* inserts that withstands the high stresses imposed by the bulging operation. This avoids a massive backup plate or other construction attached to the blank holder and simplifies die design. The punch is made 0.010-in. oversize on the dia., in the corner to compensate for wear and springback.

These utensils have a "Vapor Lock" water seal where the lid fits over the top edge of the pan. Production of this seal is by spinning and forming and the aluminum must be annealed to offset the work hardening previously imparted by ironing.

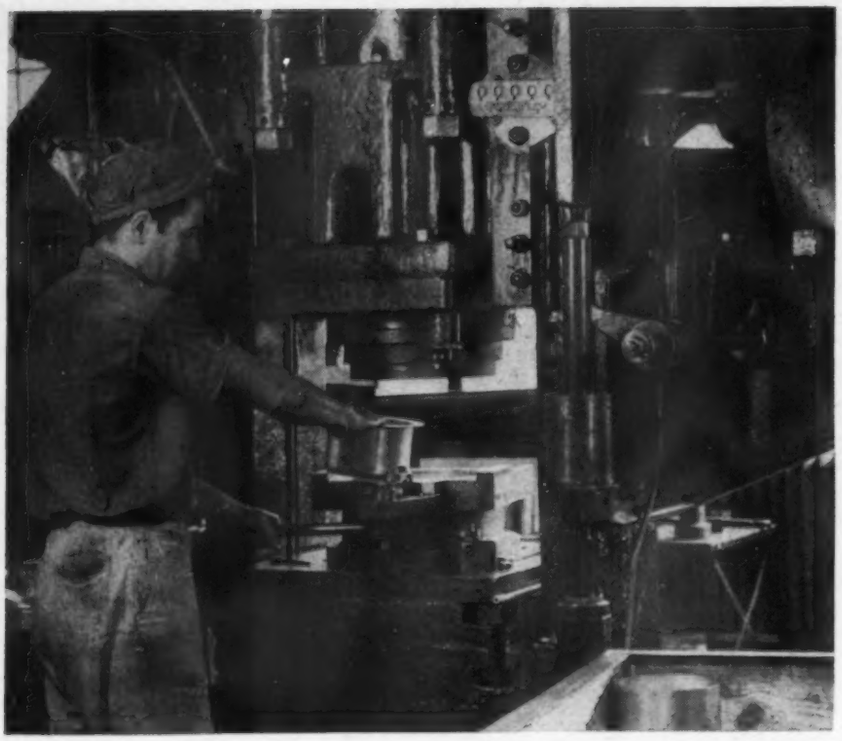
Since only the top inch or so of the walls must be annealed a series of specially designed 2000-watt electric heating units confines heat to this section. The utensils are inverted over the electric heating element until this section reaches 750 F. Heating units are placed next to the press to simplify handling.

The seal is produced by flaring the

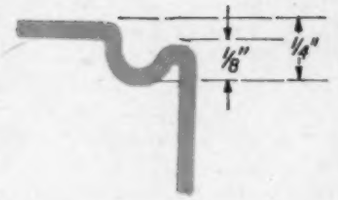




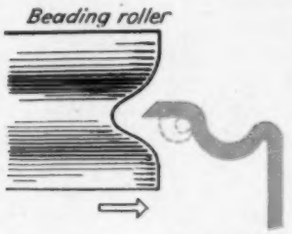
FLANGING . . . Four stages in flanging the upper section of the sidewalls by an operation similar to spinning. Work support is similar to the spinning setup except that an outer member extends up around sidewalls to support the flange, as at stage 4. In the photo, the operator's left hand controls radial feed, his right hand axial feed, of the tool



SPLIT-DIE construction must be used on the work in forming the water seal because of the previously formed flare and outside shoulder, the operator closing the die by hand after the work has been inserted in the sectional cavity and held in this closed position by cam-block action



WATER SEAL is produced in a press operation and provides a water-tight connection common to this line of pressure cookers



BEADING...

The back tool in a double-tool lathe setup imparts a 45° bevel on the edge of the flange and trims the O.D., and a forming roller puts a bead on the front side of the spinning flange. The work revolves at 2000 rpm. to give an exceptionally tight bead and an improved appearance

top of the wall with a tool similar to the cutoff, having a ½-in. radius. The operator has two lever type controls, the first moving the tool lengthwise against a stop to position it for making the flange at the correct height on the wall.

The second lever moves the tool point radially outward against the inner wall to flare out the metal as shown in an accompanying sequence of diagrams. The utensil is positioned inside a large cup which carries a heavy flange to support the metal at the corner as it is forced outward by the tool, the work turning at 1200 rpm.

Some 250 or more pieces are handled hourly, depending upon size of the particular utensil. The same machine is used to flare all utensils in the triple-thick line—6 to 8 items—by changing the retaining fixture and altering the tool setting.

The water seal flange is produced in dies on a press setup. Because the top of the utensil has been flared out and the bottom of the sides has been bulged out, a split die must be used. The operator inserts the work in the lower die, closes the split sections around it with a lever, and a cam action ensures adequate closing pressure.

The outer edge is trimmed and beaded in a lathe setup, similar to cutoff and flaring. A double-tool fixture or slide with a single control lever is used here. As the operator pulls the control lever toward him, the tool on the back of the slide cuts a 45°-bevel on the edge of the flange and trims the 8½-in. O.D. to 8 1/16 in., the tool cutting on the "back" side of the work. As the lever is pushed away the "back" tool is disengaged and a forming roller contacts the "front" side of the spinning flange of the utensil, beading the edge by forcing the material to flow along the roller face.

Materials Handling

Up to this point, the pieces have been moved from one work station to the next by gravity, rolling or sliding down connecting troughs, or have been stacked in large bins where operations did not permit con-

WELD MARKS . . . Work is well shielded as weld marks are removed with a flexible tool. Dust and abrasive particles are drawn off at the bottom of this shield

POLISHING . . . A wheel of stacked kraft-paper disks, wide enough to cover the height of the sidewall, revolves rapidly against slowly (20 rpm.) revolving work in polishing procedure. Polishing time has been cut to 35 sec.

tinuous flow of the finished units.

After beading, however, the work is handled through all subsequent production operations on a large belt conveyor with work stations spaced on either side. This conveyor moves the utensils to polishing, spin-finishing, washing and drying, handle assembly, coloring and touch-up, inspection and packing.

Polishing Technique

What little marking does occur during presswork is polished off on double-end grinders. Here the work is revolved at about 20 rpm. against a wheel made of kraft-paper disks stacked on edge to give a wheel width of 4 in. or more, depending upon the size of the utensil. The wheel is wide enough to polish the sidewall height and is contoured to accommodate both the top flange and the bottom shoulder.

These wheels are about 16 in. in dia. and run at 2500 rpm. Tripoli polishing compound, containing a little grease, a clay filler, beeswax and some fine abrasive, is used. Work is held against the wheel under considerable pressure. Each operator works a single machine having two stations, one station polishing while the other is being reloaded.

The outside bottom surface and all of the inside surface of each utensil is given a "spin" finish. A vacuum chuck holds the work while it is spun at 1200 rpm. Open-coated, 80-grit emery paper, applied by hand, produces a surface characterized by a series of fine circular lines which catch the light and can be easily cleaned. The same vacuum chuck holds the work for sanding both inside and outside surfaces. The vacuum valve and power clutch are both foot controlled, leaving the operator's hands free.

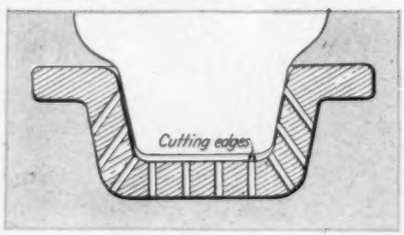
The aluminum handles, 0.102 in. thick, are welded to the 0.040-in. wall of the utensils. Makers of the equipment recommended a welding current of 15,000 amp. with 0.020-sec. time lapse from peak of welding current to point where it declines to one-half the peak value to handle this thickness spread.

The variable pressure cycle started out with a preweld electrode pressure of 200 lb. which is increased to 600 lb. for forging the weld after the welding current reaches its peak value. Aluminum pickup and tip maintenance was high under these conditions and an increased electrode pressure and lower welding current was found to reduce tool breakdown.

Electrode tips, ⅝ in. in dia., reduce metal pickup and reduce marking of the work. Tip contour is maintained by a special tip-dressing tool made of hardened tool steel with a shaped hollow upper section. Small honeycomb-type holes are drilled through the tool and the edges of the holes dress the electrode tip.

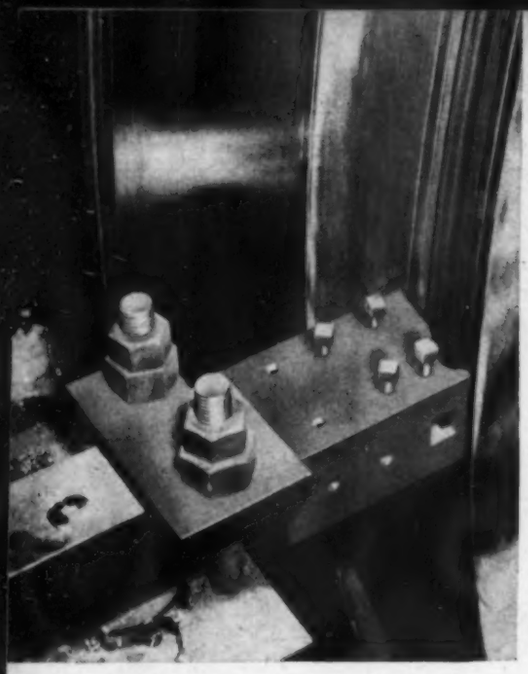
Two of these dressing tools are mounted back-to-back in a flexible fiber handle. Both electrode tips are then dressed simultaneously by inserting the pair of dressing tools between the tips, allowing the weight of the movable upper electrode assembly to press them together while the operator rotates the tool. No welding current is applied. This dresses both tips more accurately and faster than by filing.

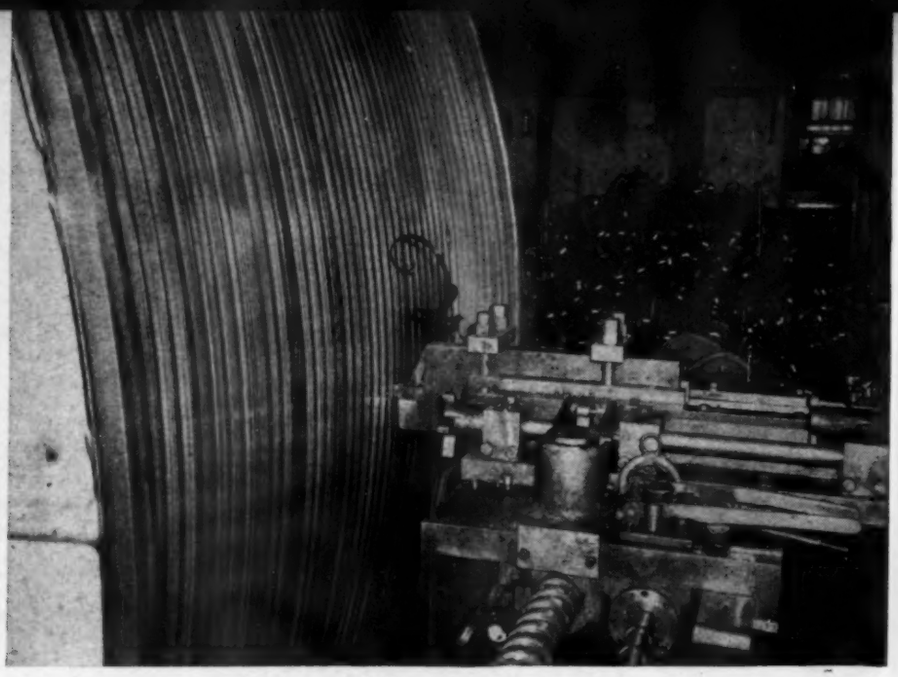
ELECTRODE TIPS are kept in good condition by this special tip maintenance tool, the holes providing the necessary cutting edges. These hardened steel tools are placed back to back to handle both electrodes and cut an operation



Warm and Ready to Go

MACHINE TOOLS are frequently run for a warming-up period at the beginning of the day shift, to avoid production of inaccurate parts. To avoid this time loss, thought is being given to making machines "constant-temperature." Cutting oil or lubricant can be kept at operating temperature during downtime of the machine with a thermostatically controlled electric heating element and low-capacity pump. And when the machine has been operated long enough for the fluid to rise above the desirable temperature, a refrigerating cycle will cut in automatically as necessary to maintain temperature.



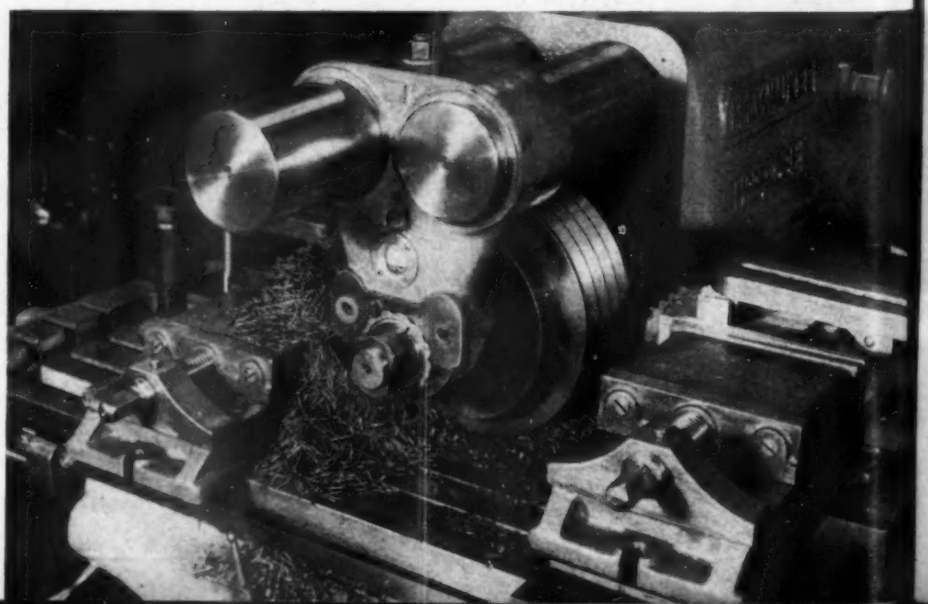


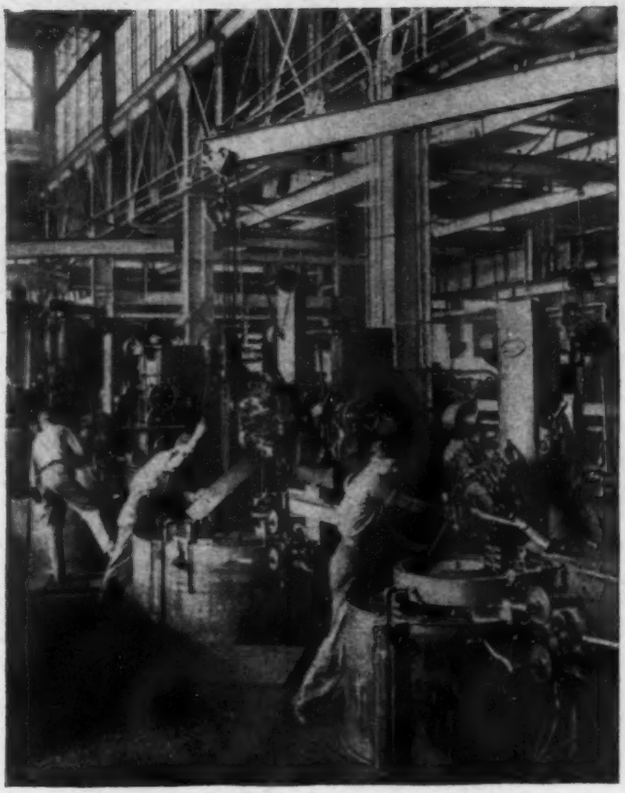
TWELVE TONS OF CHIPS..Mine hoist drums, 20 ft. in dia., with 21.5-ft. flanges and 7 ft. 10½ in. between, are machined in a pit lathe. Flange sides and face and drum O.D. are roughed, then 2½-in. semi-circular grooves are plunge-cut in the drum face for the hoist cable. Roughing tools are 1¼-in. square-shank tools tipped with Carboloy 78B, cutting at 240 sfpm. and taking a ¾-in. cut with 0.020 to 0.030-in. feed. Tools are held in a heavy extension-bar holder (left). A ¾-in. Carboloy tool roughcuts grooves, and similar form tools with 1⅜-in. radius do the finishing (right). About 12 tons of chips are cut from each drum.—*Bartlett-Hayward plant, Koppers Co.*

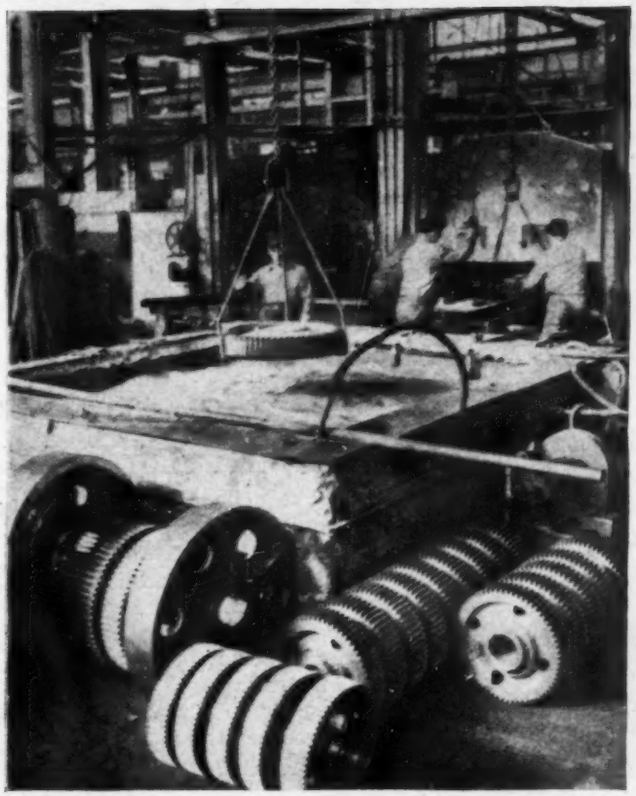
SHOP SHOTS

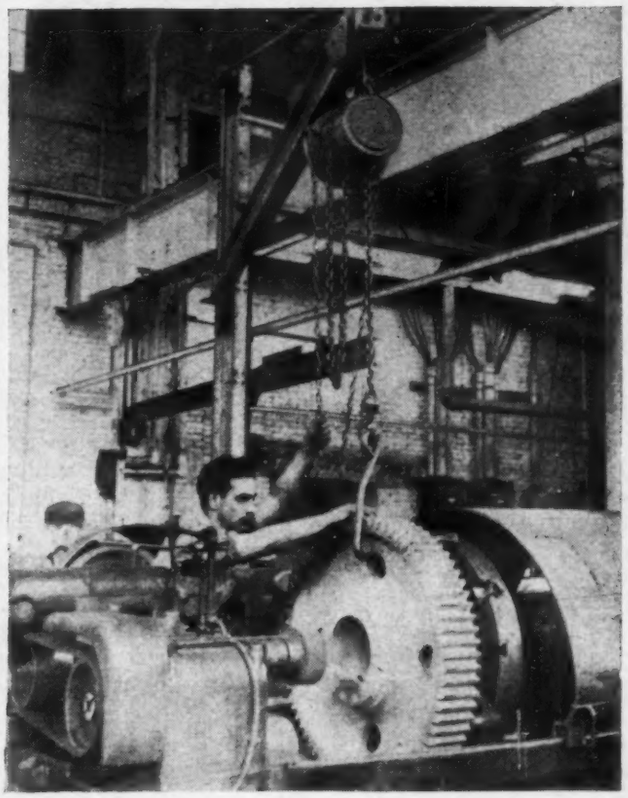
MILLER DOUBLES AS LATHE..Pulley blanks, turned to size, bored and with keyway cut, are mounted on a special arbor in the spindle of a Milwaukee CSM miller. Carbide-tipped rough and finish tools are ganged up in machine vises on the table at either side, with the roughing tools inverted as shown. The table is moved to left to feed the straight-sided roughing tools to 15/16 in. depth. As these tools bottom, spacers between them chamfer edges of the V's. The table is then moved to right to feed in the tapered finishing tools. Cutting speed is 210 sfpm., at feed of ⅝ in. per min. and chip load of 0.010 in.—*Kearney & Trecker Corporation.*

SEEING IS BELIEVING . . Tool engineers at Woodward Governor Co., Rockford, Ill., are strung along the front of a glassed-in balcony overlooking the shop, so they can see the machine they're tooling, as well as its relationship to adjacent machines in the production line. They can telephone directly to any part of the floor and see the men to whom they speak. Eaves outside the glass (lower edge at photo top) avoid glare from flush fluorescent shop lights. The entire plant is windowless, soundproofed and air-conditioned









SPECIAL HANDLING . . Locomotive gears welded from rolled-steel sections, when produced in quantity, can be handled easily and safely with equipment like this. (A 27-in. dia., 6-in. face gear is the model.) These four pictures show typical steps. Power trucks with adjustable forks (upper left) bring several blanks from yard to Bullard vertical turret lathes. Turning, facing, boring and hobbing are done with the gears handled by electric hoist and sling on long jib cranes (upper right). A jib crane with electric hoist loads furnaces, and an overhead traveling crane handles heated gears from furnace to quenching tanks. Each has a set of triple hooks (lower left.) Gears are then passed in groups of six on a transfer car to grinding. For bore grinding, the gear is set by jib crane, hand hoist and special hook (lower right). *—Gearing Div., Westinghouse Electric Corporation.*

The nickel-plating layout, consisting of separate precleaning, plating and final-rinse tanks, is served by an automatic elevator conveyor for transferring racks of parts from tank to tank. The elevator, shown in down position, has arms extending over the tanks to carry part racks

Automatic Handling Aids Plating Success

BY M. E. KILROY, METALLURGIST, DAYSTROM CORPORATION

EVEN before installation of our new system, electroplating at Daystrom was a far cry from the dunk-and-dip days—when plating was an art, not a controlled technical process. Days when each plater had his secrets of success, when he knew that if he did a carefully guarded "something" to his bath or temperature or current or time, something else would happen—maybe. Days when each secret was jealously guarded like a vestal virgin and a stranger was not even allowed within smelling distance of the layout.

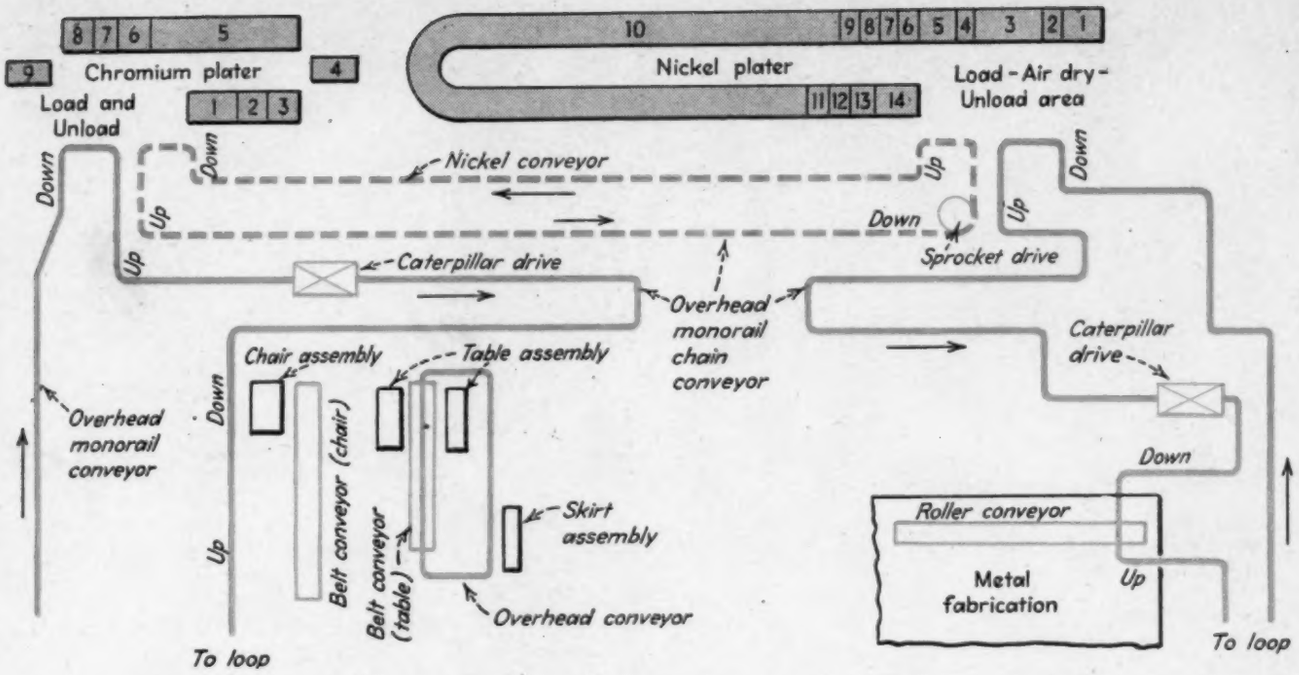
But far cry as it was from those days, our plating setup lacked efficiency. We had a semi-automatic system that was ill fed, ill housed and totally unfit for postwar competition and production. Labor cost was high, plating not too good and productive capacity far below our expected business in the manufacture of metal furniture.

Present production is based on integration of three overhead monorail chain conveyors. One conveyor carries fabricated parts from metal fabrication to nickel plating, the so-called nickel conveyor carries nickel-plated parts to chrome plating and the third conveyor carries finished parts to assembly.

Metal fabrication of furniture parts is relatively simple, as finished parts consist mostly of welded round tubing bent to required shapes. The S frame of a chair, for example, is made of high-strength steel received in wide rolls, and processed in the following operations:

Slit to width
Roll-form, weld and cut to length
Deburr
Polish
Pierce 4 holes
Bend frame 90°—Bend 1
Bend frame 90°—Bend 2
Bend frame 90°—Bends 3 & 4
Press-bend frame
Polish 4 bends

Automatic handling steps up production 100% with no labor increase, only 35% more space and few rejections



Three overhead monorail chain conveyors feed parts from metal fabrication to nickel plating, nickel-plated parts to chromium plating and finished parts to assembly. Platers are automatic, elevator-type conveyors. Operation numbers are keyed to accompanying flow chart

Inspect and hang on conveyor
Unload, rack, unrack, load (nickel plate)
Unload, rack, unrack, load (chrome plate)
Inspect

Assembly of chairs and tables is also set up a production line basis, with belt conveyors to carry assembled chairs and table tops to packing. An auxiliary overhead conveyor carries table skirts from subassembly to assembly area.

The success of the production operation depends on the capacity of the plating units and quality of plating. It was decided that the finish, a decorative chrome over a bright nickel, could best be obtained by installation of two Hanson-Van Winkle-Munning automatic plating conveyors of the elevator type.

Each conveyor has arms extending out over the solution tanks to carry racks on which chair frames, table legs and other parts are supported. The carrier arms are mounted on "roller skates" set in vertical guide channels which are connected to an upper and a lower conveyor chain.

The guides are located between these chains at intervals determined by tank spacing. When arms are in the raised position, they are moved forward by the chains a distance equal to their spacing, or from one solution to the next.

The elevator then acts to im-

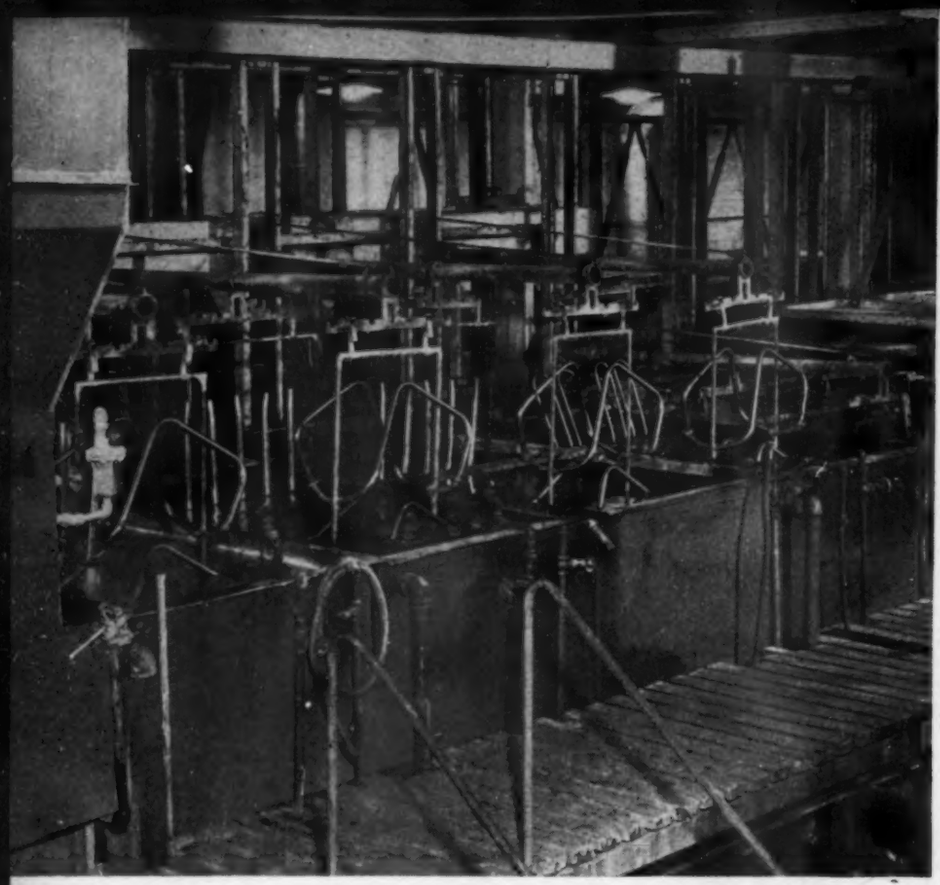
NICKEL AND CHROMIUM PLATING OPERATIONS

Nickel Plating

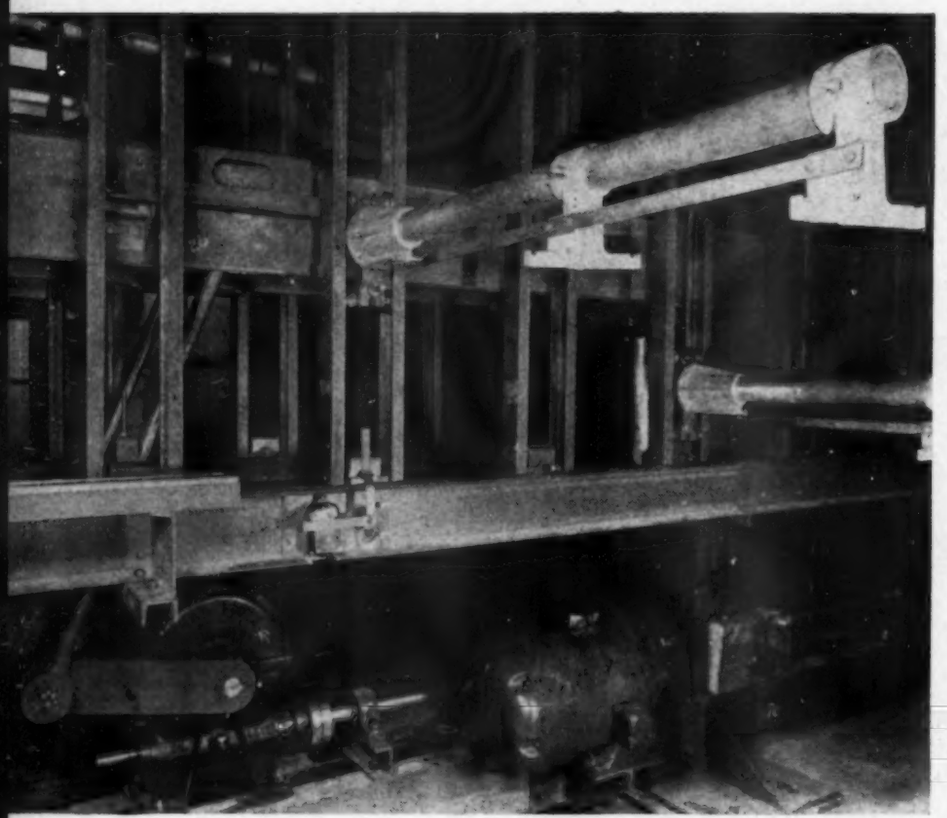
OPERATION	SOLUTION	IMMERSION TIME	TEMP., F.
1	Solvent cleaner (Penn. Salt)	42 sec.	Room
2	Spray rinse (cold water)	6	60-65
3	Soak cleaner (Penn. Salt) alkaline—8 oz. per gal.	150	200
4	Spray rinse (cold water)	6	60-65
5	Electric cleaner (Penn. Salt) alkaline—10 oz. per gal.—work anodic	42	210
6	Spray rinse (hot water)	6	150
7	Dunk rinse (cold water)	6	60-65
8	Electric acid dip (sulphuric acid 10%) work anodic—current timed controlled	6	Room
9	Dunk rinse (cold water)	6	60-65
10	Nickel plate (9H bright nickel with 1% cobalt-nickel anodes)	24 min. 6 sec.	160
11	Reclaim rinse	6	Room
12	Spray rinse (cold water)	6	60-65
13	Dunk rinse (cold water)	6	60-65
14	Dunk rinse (hot water)	42	180

Chromium Plating

1	Electric cleaner (Penn. Salt) alkaline—4 oz. per gal.	42	150
2	Rinse (cold water)	6	60-65
3	Electric acid dip (sulphuric acid) work cathodic	6	Room
4	Rinse (cold water)	6	60-65
5	Chromium plate	186	105-120
6	Reclaim rinse	6	Room
7	Rinse (cold water)	6	60-65
8	Rinse (cold water)	6	60-65
9	Rinse (hot water)	6	180



Chair frames and table legs are held on racks suspended from conveyor arms. Racks are designed so parts can be loaded and unloaded without removing racks from conveyor arms. This speeds up operation and reduces manual work. Racks are quickly changed for other parts



Each conveyor arm, mounted on "roller skate," is raised by a flipper engaging the skate. At the bottom of each channel is a reset rod for opening the flipper. Arms can be kept down as required by process

merse the parts in the solutions. A roller on each roller skate engages a flipper for either lowering or raising. When a rack of parts is to remain in a solution for two or more cycles, flippers index the arm to remain down for the required time.

Elevator lift is accomplished by crank arms from gear reducers spaced on equal centers. Chain drive and elevator lift are interlocked so forward motion is obtained only with the elevator in its raised position.

The nickel conveyor has 72 carrier arms with 42-in. spacing, an elevator lift of 50 in., immersion time of 6 sec. and transfer time of 30 sec. Complete cycle is 43.2 min. The chrome conveyor has 20 arms with the same spacing and the same immersion and transfer times. Its cycle is 12 min.

Capacity of the two platers is therefore the same. With each arm carrying two racks and each rack designed, for example, to carry two chairs, as many as 400 chairs per hour may be plated.

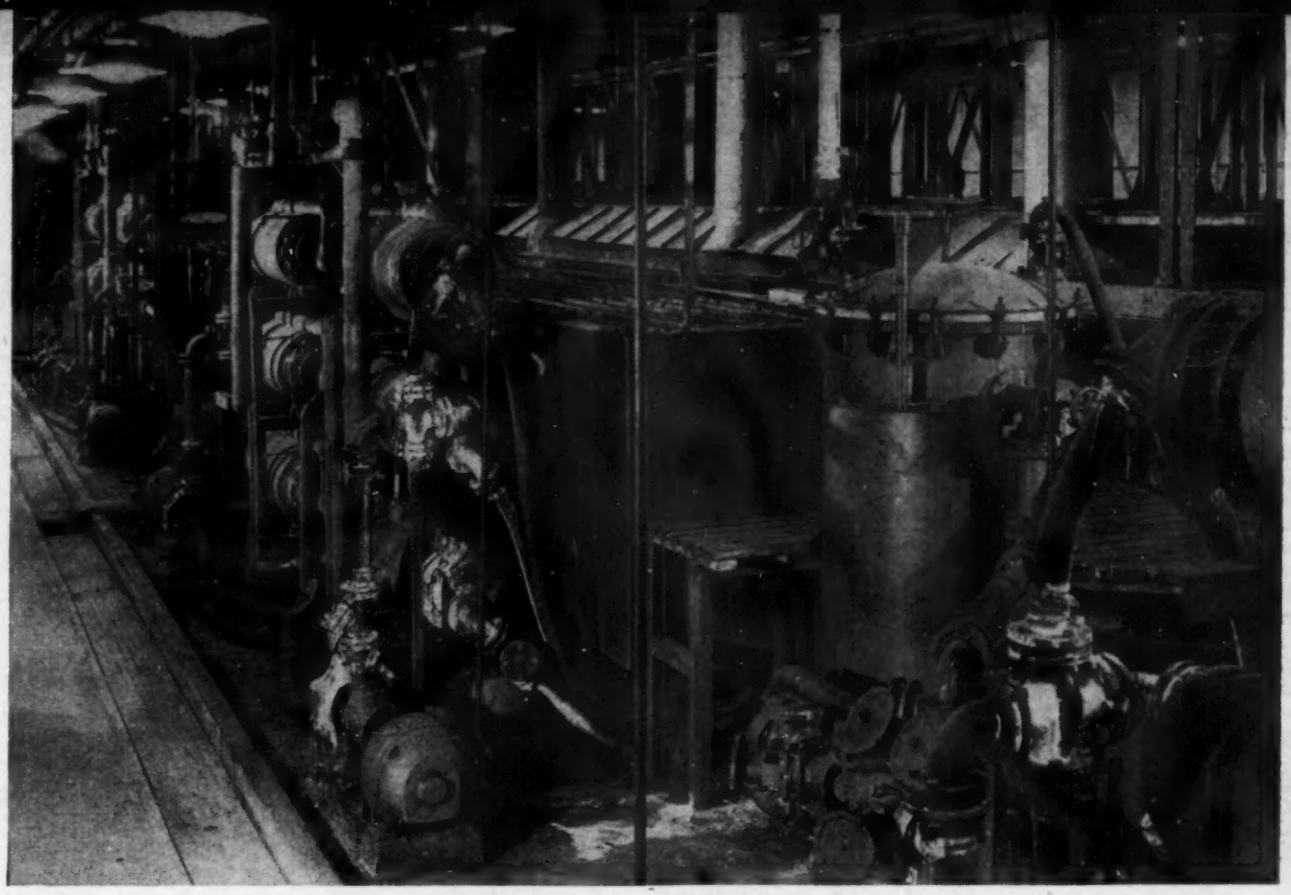
Bright Nickel and Chrome

Parts are plated with 0.0008-in. nickel and 0.000015-in. chromium. The 40,000-gal. nickel tank contains a bright-nickel solution, known as 9H, that deposits an approximate 1% cobalt-nickel alloy. Anodes also contain 1% cobalt. Required thickness is deposited in approximately 24 min. at a current density of about 40 amp. per sq. ft.

The bath (patented) consists per gallon of 32 oz. nickel sulphate, 4 to 6 oz. nickel chloride, 0.3 to 0.5 oz. cobalt sulphate, 4 oz. boric acid, 0.1 oz. ammonium sulphate, 1/3 oz. formaldehyde and 6 to 8 oz. nickel formate. The pH, checked several times daily, is held from 3.6 to 3.8 to get maximum brightness and throwing power.

Nickel sulphate, together with nickel chloride and nickel formate, furnishes a nickel concentration of approximately 10 oz. per gal. The primary function of the nickel chloride, however, is to promote sufficient anode corrosion. Boric acid and nickel formate are added as buffers to maintain desired pH. The formaldehyde appears to act as a cathode depolarizer in preventing accumulation of gases at the cathode and possible pitting of the nickel coating; its concentration also affects brightness.

The chromium solution, of 5,000-gal. content, deposits a 0.000015-in.



Plater accessories include purification tanks, heat exchangers and filters. The nickel solution is purified continuously to insure good deposits. No brightening agents are removed during purification

coat in 3 min. at a current density of 100 to 150 amp. per sq. ft. Thickness of the decorative coating is held under 0.00002 in., as high internal stresses in greater thicknesses cause microscopic cracks and reduced protection to the nickel coating.

As continued brilliance with no tarnish is an absolute necessity in metal furniture, decorative chromium plating over bright nickel is the answer. The nickel protects the steel against corrosion, needs no polishing before chromium plating and is protected from tarnishing by the chromium coating.

Appearance of the chromium depends on the quality of the nickel plating and, over a good nickel plate, it will not peel, crack or loose its smooth and highly brilliant surface. The nickel solution we use has the advantage of depositing a fine-grain coating and one that shows no laminated bands.

Plater accessories are two purification tanks, two filters, five banks of three Duriron heat exchangers each, generator setup and underfloor nickel and chromium storage tanks. The nickel solution undergoes continuous filtration and purification. Continuous purification is practiced, because brightening agents are not removed. The purification units draw solution from opposite ends of the tank and purify it at a low current density, followed by filtration through activated carbons and clays. Anodes in the purification units are of the 1% cobalt-nickel alloy, as in the plating tank.

Water for solutions is given a deionizing treatment in an Illco-Way unit of 1,000-gph. capacity. Hard water from deep wells passes through tanks containing synthetic resins. One tank, the cationic exchanger, removes all positive ions, or cations, and holds them in the resin bed, while hydrogen is introduced in their place. This acidic water formed from combination of hydrogen and sulphates, carbonates, etc., passes through a second resin bed, called the anionic exchanger. Here anions are replaced with OH ions. The H ions from the first exchanger then combine with OH ions from the second to form water. A zeolite softener insures water free of magnesium and calcium for use in cleaners and cold and hot water rinses.

Automatic Handling Advantages

Installation of automatic handling through plating processes pays for itself. We have had a 100% production increase with no additional labor cost, and will increase this by 30% with greater generator capacity now planned. This 100% increase was gained with only 35% increase in cubic-space requirements.

Racks have been designed to provide easy loading and unloading, so they can be kept on the machine until the operation changes. Flexibility of the conveyor permits a quick change to any of the forty different parts now being plated.

Theoretically, there should be no rejections, and once the variables are under control, there are none. For instance, iron oxide formed from welding of the tube and distributed over its entire surface, intermixed with polishing compounds by action of the polishing wheels, was extremely difficult to remove completely. Introduction of the 10% sulphuric acid, in which the work can be made anodic for any desired part of the immersion period, not only solved this problem but proved much more economical than previous practice.

Pinning down such variables, uniform handling of work and checking the solution daily by volumetric or colorimetric analyses can, and does, give us consistently good deposits with high production and few rejects.

When Metalworking Was An Art

THE SHREWD and twinkling eyes behind the glasses in this portrait have seen —and pictured—more metalworking developments than any other pair. They belong to Fred H. Colvin, editor emeritus of **American Machinist**, who this year celebrates his fortieth year with us, his sixty-first as a contributor. Under the title "Sixty Years with Men and Machines," Mr. Colvin has written his autobiography—packed to the covers with reminiscences, travels, and his impressions of contacts with the great and near-great of the industry for the past half-century. Scheduled for publication by Whittlesey House on April 7, this 300-page book reveals that he has written under many names, most familiar being Henry C. Francis, Frank C. Hudson, Chester H. Franklin, and most importantly, John R. Godfrey—whose opinions in our "Seen & Heard" column have stirred shop men to think and to battle for most of the twentieth century.

The accompanying excerpt is from the chapter "Giving the Machine A Voice" which details the tribulations of early editors in uncovering, and disseminating, the technical "know-how" that benefits its discoverer most when it is shared.—The Editors

THE GENERAL attitude among old-timers of sixty years ago was that machine-tool work was one of the fine arts, like the paintings of the early Renaissance, and that the inexperienced young fellows coming along then could never hope to equal, let alone surpass, the fine coordination of hand and eye that made the old toolmakers, with their primitive equipment, the marvels of their generation. As new and more accurate machines and gages were introduced, making intuition and sixth sense a less-important qualification for the first-class machinist, the old-timers complained, as only skilled handcraftsmen can, that their art was being debased by the machine.

Not that a few of the old mechanics were anything less than genuine marvels in their own way. There are indeed few workmen today who can chip or file by hand to compare with the great masters of fifty or sixty years ago. The old toolmakers of that vanished day performed remarkably accurate work without the use of the fine instruments that are almost a commonplace in today's shops. These pioneer artisans had cultivated the "caliper touch" to an extraordinary degree of refinement, beyond which it is not possible for human senses to go . . . But these estimable gentlemen, and others of their school, made the fundamental mistake of regarding machine-tool work wholly as an art. Art it is not. Though skill and judgment are necessary, machine-tool work is primarily a science, and it depends upon certain laws of physics, mathematics, and chemistry; like any other branch of engineering, it can be developed fully only by applying these laws in practice . . .

Some of the old mechanics, for example, had no use at all for the newfangled taps and dies that began to appear near the close of the past century. One skilled toolmaker in Greenfield, whom I knew slightly, believed they were nothing but a bother, and preferred a tap made from a piece of square steel with teeth cut out on the corners, which he claimed eliminated the need for fluting or squaring the shank. His favorite die was made by annealing an old, worn-out file, drilled and tapped in the center, with four small holes outside the thread drilled and filed into the tapped hole. This, he said, gave the necessary cutting edge and chip clearance, as well as the diestock, all in the same piece . . .

Even the budding science of metallurgy was looked upon as a secret art by some of the early shop men, and indeed at one time every job of heat-treating, or of hardening and tempering, took on the nature of sorcery and black magic. Most of the heat-treating work was done in an open forge with a hand-operated rotary blower, and every operator had his own personal technique of "coking-up" the fire and applying the draft. There was much solemn hokum about the carbon composition of various steels, the proper ingredients to be used in the hardening bath, and even the kind of weather that should prevail during the ritual . . .

There was one wizard I heard of, named McCandless, who guarded his secret for a quenching bath with infinite care. Once a week he would mix up a new batch of chemicals, keeping everyone at a prescribed distance during this solemn rite. To prevent possible rivals or secret agents of other shops from learning where he bought his ingredients and what his materia medica consisted of, McCandless worked out a system whereby on Saturday afternoons he would sneak off to a drugstore, buy one of his priceless ingredients, and then, to cover up his tracks, would saunter casually into the nearest saloon for a drink. When the coast was clear and the drink finished, he would slip out of the saloon by way of the back door and dash off to another pharmacy a few blocks away for the second ingredient. Just in case anyone was still on his trail, he would then drop into another tavern, polish off another three fingers of Old Crow, and like Operator X of the spy stories (only minus the traditional cloak and dagger), he would again vanish into the mysterious night in quest of the third, fourth, or ultimate ingredient.

Whether it was the thrill of adventure or the amount of Old Crow consumed in this manner, McCandless was always in such a state of heightened sensitivity on Monday mornings that he rarely got over the shakes before noon. On one such Monday morning he cracked two sets of cams in his secret hardening process, leaving them buried in the muck at the bottom of his cauldron while he dashed out to the nearest bar for a couple of quick ingredients. The manager thereupon called in a young machinist named Karl T. Herrmann who was groomed along more scientific lines. He first cleaned all the sludge out of the barrel, then hardened a new set of cams with clean water and a little salt, "drawing" them on hot sand. They came out with exactly the amount of file hardness required, and when McCandless of the mystic rites finally showed up he learned that science had suddenly displaced magic in heat-treating, and that he was minus a job.

TALKING SHOP

Long Ride

EFFICIENT use of materials-handling equipment demands as many capacity hauls as possible. Be guided by the story of the old Scot who went to a stable to rent a riding horse. "How long?" asked the stablemaster. "As lang a one as ye hae," said the Scot, "There'll be five of us agaeing."

Down Time

WE FIND that downtime is somewhat of a problem. In Colombia, downtime was for a time considered rather lightly. One firm down there had a couple of plastic injection molding machines, the costly tooling being constructed in a Massachusetts tool and die shop. If anything serious happened to the mold, it was shipped to Massachusetts for repair, and the machine was down for three months at a time. Nobody worried then.

Today, it is acknowledged that the only answer to this problem and the peculiar climate (accelerating corrosion) is stainless-steel molds—our old friend type 420, in fact. The same firm that used to enjoy three months downtime has now been running stainless-steel molds for nearly eight years—without a return to the United States.

Pre-Shot

PACKARD shot-peened connecting rods and rocker arms on marine engines during the war instead of polishing them. Savings were 42 manhours per engine and increased fatigue life.

Factor of Ignorance

ONE auto-body maker has spent over $150,000 analyzing *one* model of one body style, trying to reduce weight without impairing service strength. It has been found practically impossible to calculate relative strength of various body components because service loads are unknown (hence so is factor of safety). Stress coats and stress gages wielded by transplanted aircraft stress engineers have shown suspensions vital in body strength, so new spring suspensions may force heavier bodies to give desired stiffness . . . New bodies with glass all around will weigh more—because the glass is twice the weight of the steel panel it replaces . . . Interesting is the fact that the new wide doors and invisible hinges make hinge weight a major item in body-weight analysis.

Cooling Quirks

LODGE & SHIPLEY, faced with a thin tube section that threatened to collapse when chucked in a turret lathe, passed the cutting compound *inside*. Thus the coolant both cools and stiffens the work . . . Bryant, internal-grinding a 12x12-in. bearing with a 6-in. open-structure wheel, found cooling a problem, now feeds the coolant *through* the wheel, letting centrifugal force help get the coolant to the work surface and flushing the wheel at the same time.

Electronic Woodpecker

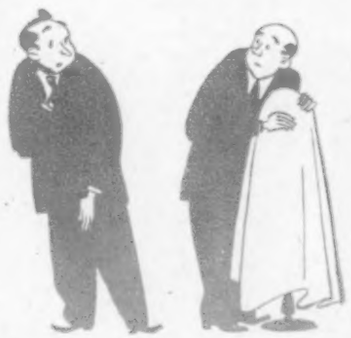
MODERN TOLERANCES require tool feeds of a tenth of a thousandth. When "feeding" involves moving the 25-ton column of a horizontal boring mill, it poses a problem; the feed drive builds up pressure until the saddle overcomes static friction and "jumps" several thousandths along the runway. G. A. Gray has beaten this by using the same trick a toolmaker does when he puts pressure on the feed screw, then slaps carriage or frame to get microfeed. Gray has a "microjog" button on the pendant control, which starts the column-feed motor at its slowest speed and lifts a light babbit weight (by solenoid) off the runway behind the column. Jogging the button thus puts twist in the drive shaft, then drops the weight to set up a differential vibration that allows the column to slide a tenth or less. When desired feed is obtained, the clutch is thrown, releasing drive torque and locking the saddle.

Guards Saved by King

IN DESIGNING the war-built plant of King Machine Tool, Ed Muller applied common sense to guarding. By passing truck, car and pedestrian traffic past the same gatehouse, then fanning it out on the far side, he needed only one guard per shift . . . Truck approaches, incidentally, are provided with turn-arounds, so the truck can readily back up to (and through curtain doors, into) the shop.

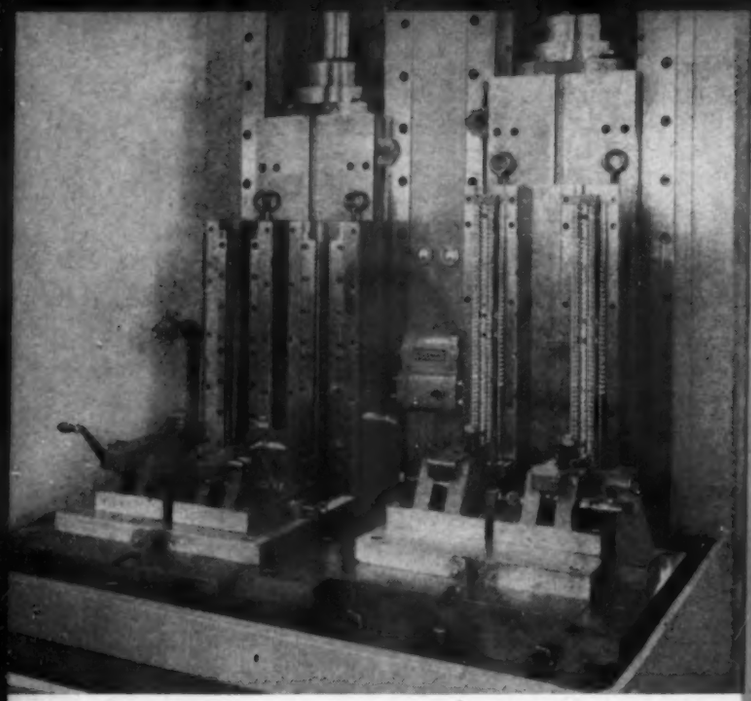
The Little Things

IN DIE-CASTING or injection-molding practice, little things sometimes loom importantly over a long stretch of time. One firm, with a fine record for low maintenance cost, says that when a machine is closed down for any period of time, the mold or die should be brought up within an inch of being closed. This will take the weight-imposed strain off guide pins and rods and will substantially lengthen the life of bushings. Over a period of time, the weight of tooling on these horizontal members will take them out of alignment.



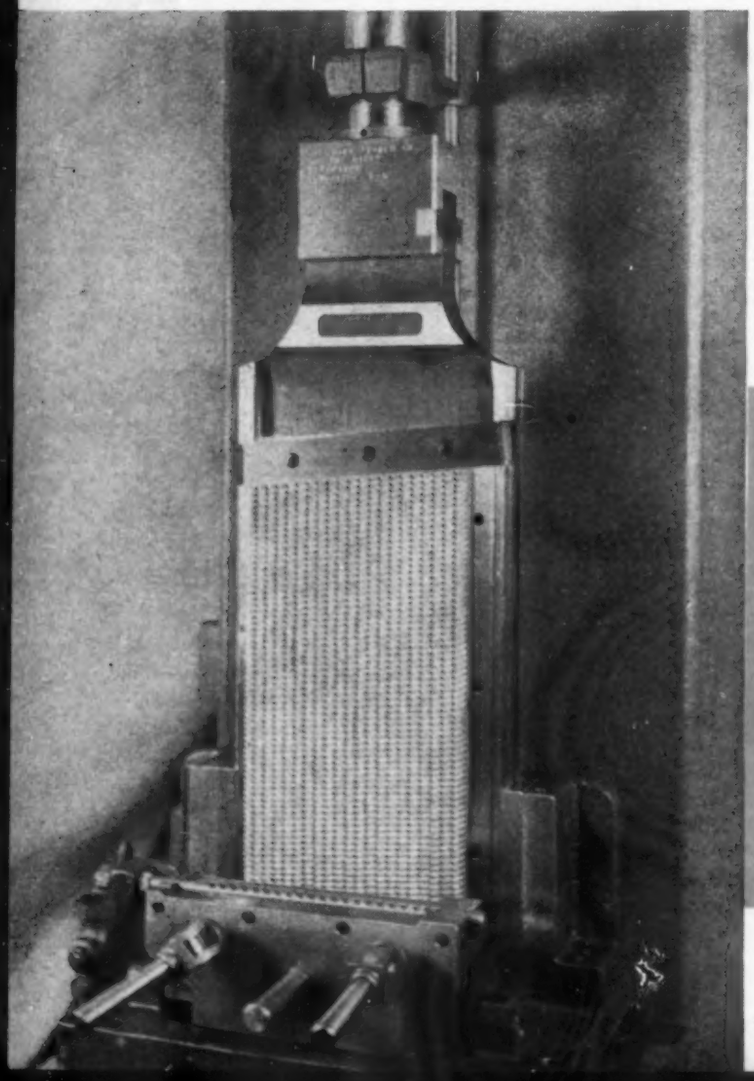
Cloak and Dagger

WE KNOW from experience that it is hard to get into certain plants for fear that technical know-how will leak to the dastardly competition. A top sales engineer from one of the steel companies says this is not always true. He had been kept in the waiting room of a certain plant on every trouble-shooting visit for a year. The hush-hush and "we don't want this to leak out" atmosphere finally broke down, the engineer went in the plant and cleaned up the trouble—in an hour. But he did find out that this plant was protecting not progress, but obsolescence.



MULTIPLE STATIONS increase output. Here the big end of a connecting rod is completely machined on a double-ram broach having four stations. Operations are: first station—broach the bolt bosses and slot the two sides preparatory to separating the cap; second station—split cap; third station—broach the parting faces and the half-round of the rod; fourth station—broach the parting faces and half-round of the cap. Note: all broaches are built up from inserts

Good Fixtures Make Broaching Suitable for Many Jobs



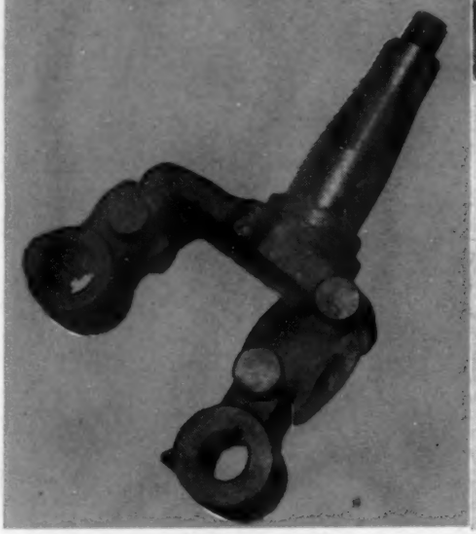
BY HARRY H. GOTBERG

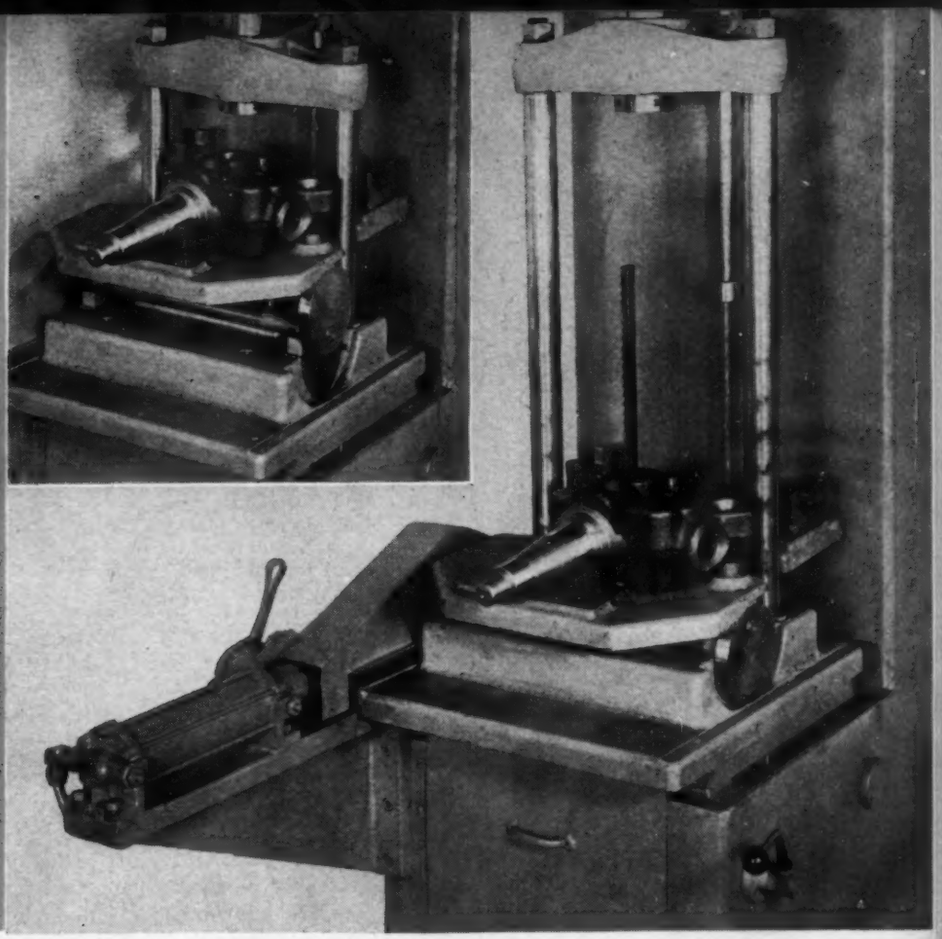
CHIEF ENGINEER, COLONIAL BROACH COMPANY

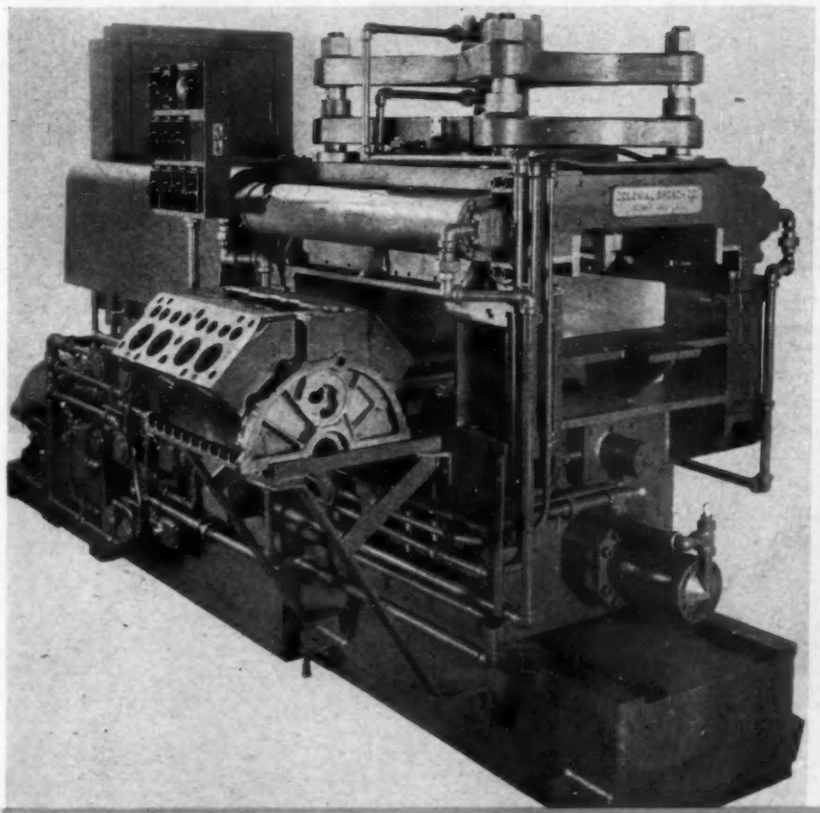
An almost-endless variety of setups can be made to work on standard equipment: more troublesome applications warrant special-purpose units

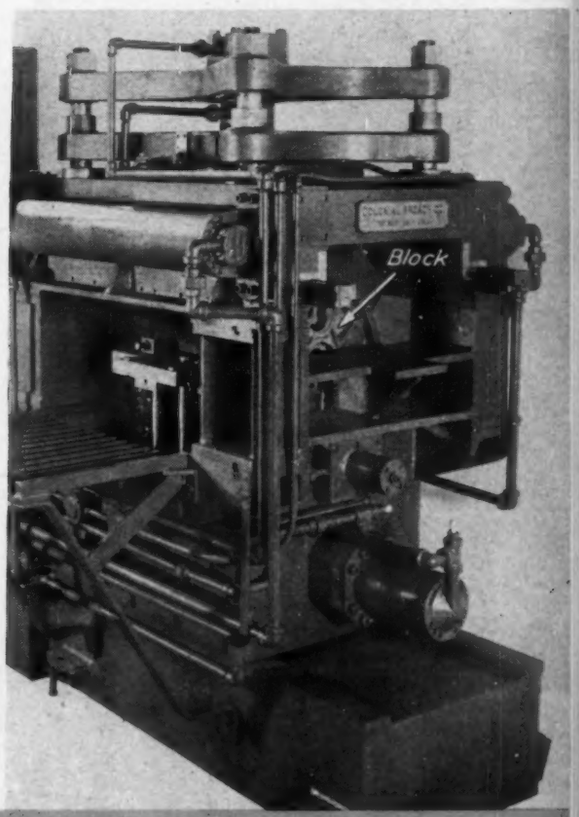
TWENTY-ONE NOTCHES are cut simultaneously in a welded tube, used in the seat adjustment mechanism of an automobile. The tube is loaded into a trunnion-type fixture equipped with cam clamps, and the assembled-type broach is pushed down after the fixture is rotated into the cutting position

SUITABLE DESIGN of the fixture makes it possible to use a 10-ton press for broaching a keyway in one arm of a steering knuckle. The press is fitted with a pull-down broaching attachment. So, to return the broach through an unmachined part without dragging, the fixture is raised and moved forward by an air cylinder and cam arrangement. The fixture is loaded and unloaded in the down position



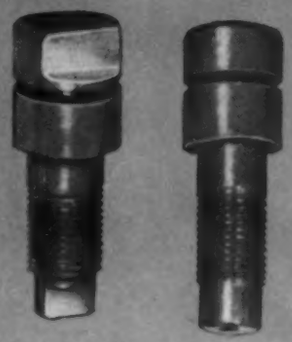


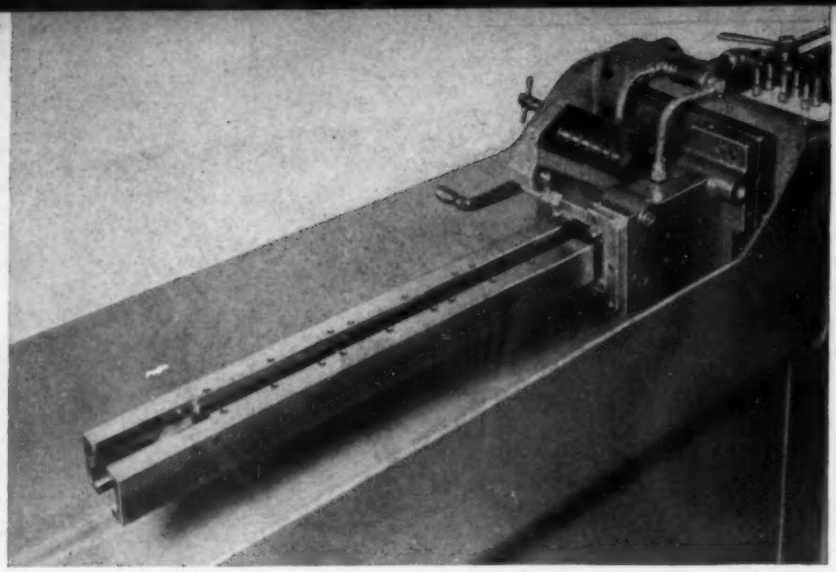


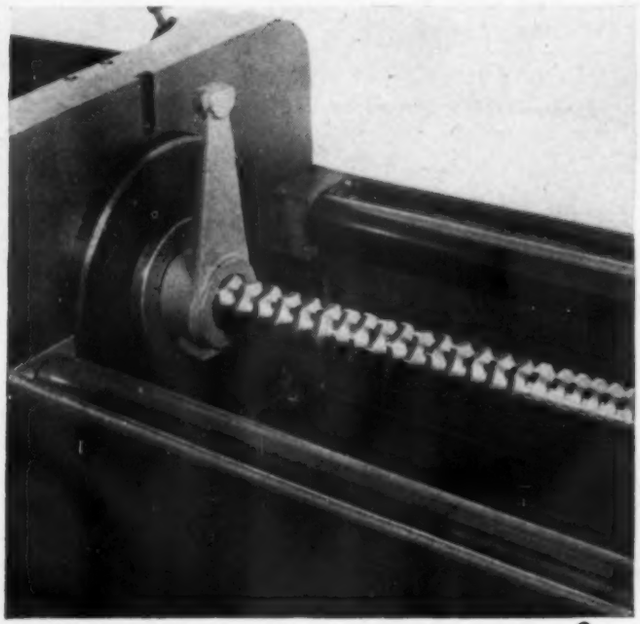


LOCATING SURFACES are frequently broached, even though relatively small. As the first operation on a well-known V-8 cylinder block, two small pads on top of the casting are so machined. The cylinder block moves into the machine on a conveyor, is raised to cutting position by a hydraulic lift. Taper plungers enter the bores on both sides to equalize metal removal. When clamped, two horizontal rams move the broaches over the pads to be machined. Although a large machine is involved, the operation is the key one on the block and paces production, hence a costly installation is warranted

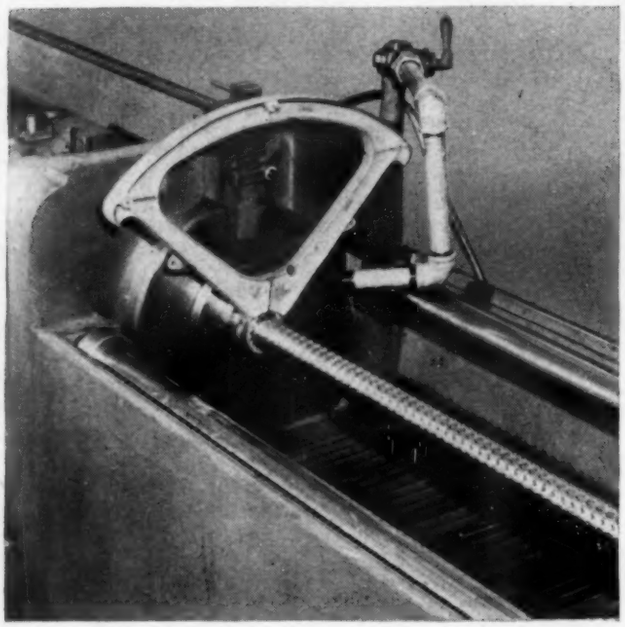
DOUBLE FLATS are broached on both ends of a special bolt, six pieces at a time, on a horizontal machine. The bolts are loaded into a swivel fixture for this operation



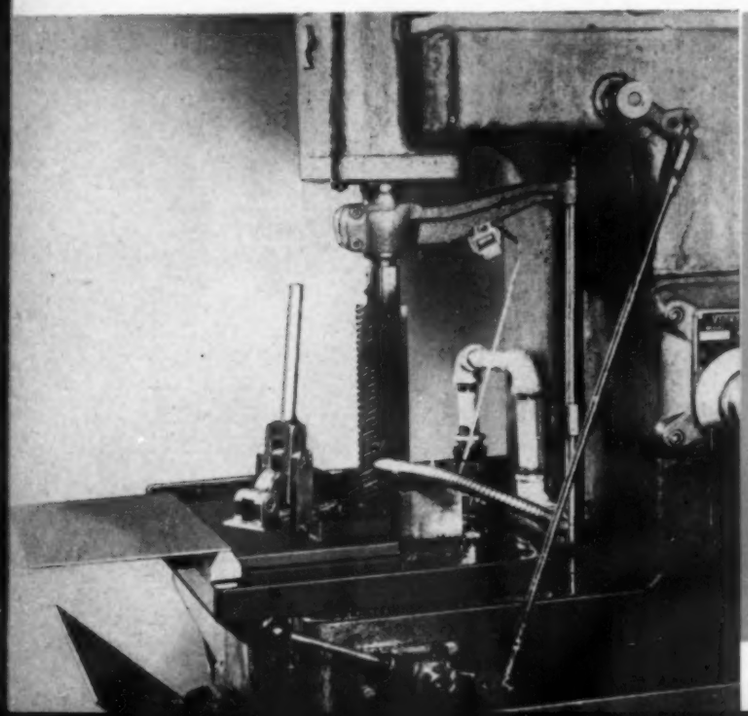




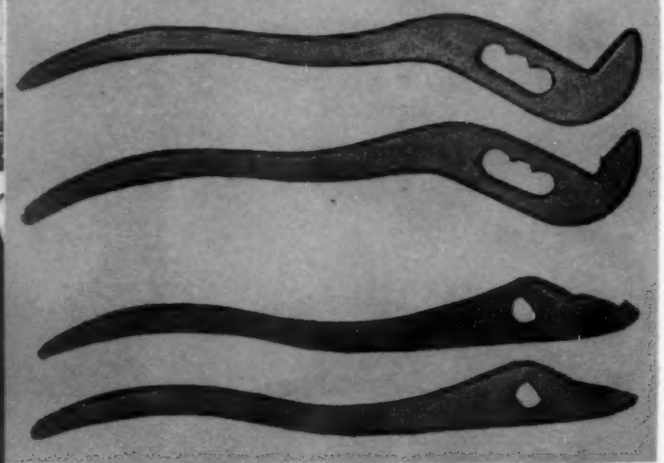
STAGGERED cutting edges, or teeth, on the roughing portion of a "rotor" broach reduce chip load, when broaching the hole is the first operation on a rough casting or a forging. Finishing section of the tool has plain round teeth



INTERNAL SPLINES are easily broached in a variety of parts, using the horizontal type of machine. Here an aluminum aircraft steering quadrant is so splined, using a tool with plain round teeth at the start for sizing

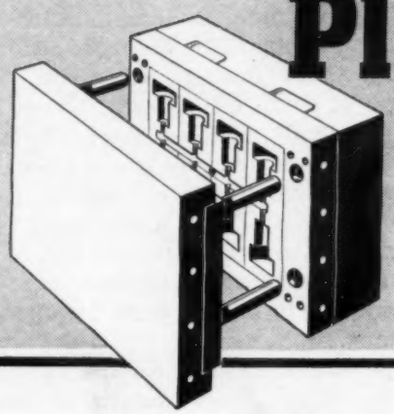


SMALL broaching presses serve many production purposes, when equipped with simple fixtures. Here, plier jaws are serrated with a 2-ton machine. A flat serration broach is used. Production averages 700 pieces per hour



HOW TO CUT COSTS OF

Plastic Molds



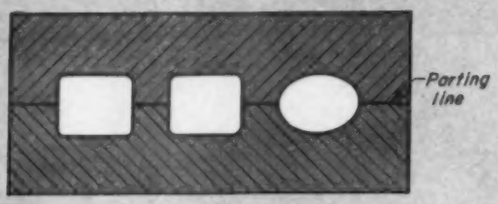
By HAROLD L. FLYNN
ASSOCIATE EDITOR

THERE is a trite, but true, saying that "a molded plastics product is no better than the mold that produced it." This has been the story of the plastics industry from its early days, even after the inception of the injection molding machine. It has always been a question of "tooling cost," for nothing but the best tooling could guarantee results from a process that involved abrasive, reactive materials like plastics with high molding pressures.

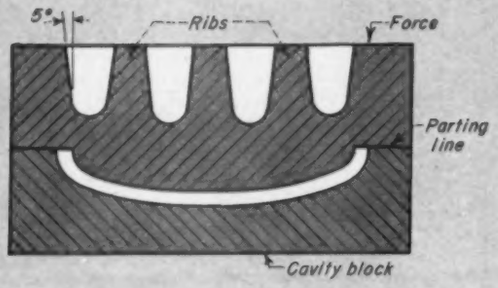
As the industry swung out of the depression and into the war period, it became clear that the production end had outgrown the mold-making end — in fact it had almost outgrown raw-materials capacity. A step towards solution has been taken by the Guy P. Harvey & Son Corp., in developing a method of casting stainless-steel cavities, forces and inserts that brings an element of mass production into mold making and offers a solution to high tooling cost. The method, and the application, naturally has its limitations—but it is a step in the right direction and may be judged as one of the most significant developments in the industry since introduction of the injection-molding machine.

In the following pages, pattern-making methods will be outlined and design for cast cavities clarified, enabling the mold maker and molder to expedite tool construction for certain specific requirements.

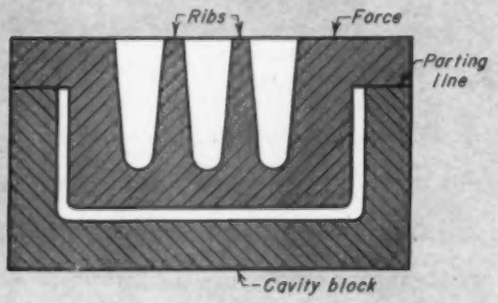
CASTING DESIGN



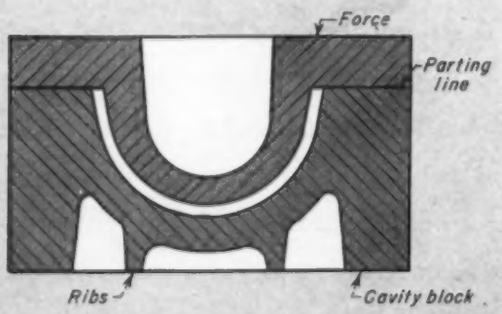
Back coring is not required in thin matching castings which have relatively shallow cavities



Reinforcing ribs, cast in the force to provide uniform wall thickness, should be on 1-in. centers to provide required strength and economize on stainless casting weight. Maximum draft of 5° is good practice



Where the cavity forms a uniform wall on sides and bottom of the product, the cavity block need not be cored but the force should be cored and ribbed on the back



Cavity blocks used to form cylindrical objects should be cored and ribbed but the force, which is self-supporting, need not be cross-ribbed

PLASTIC MOLDS are produced by three current methods, each necessary to its specific end. They are machining, hobbing and casting, and they cover the requirements for both compression and injection molding of plastics. Casting, like hobbing, becomes of distinct advantage where multiple molds are required and where the limitation in size is not too great.

Casting, the method under discussion, went through a considerable developmental stage at the Guy Harvey plant before standardization of the present method. Some stages involved the use of copper and bronze alloy castings, iron-steel castings, hard rubber and ceramic cavities, electro-formed shells, sprayed metal shells and powder metallurgy. A number were initially successful, but any great amount of detail incorporated tended to wash away.

Subsequently, stainless steel was found to be the answer. The method by which the castings are produced is called peripheral casting, patented by the Stainless Cavity Corp., a subsidiary of Guy P. Harvey & Son Corp. Cavities are cast to size and given a satin-gray finish by liquid-honing and polishing, and brought to mirror finish by further stoning and polishing.

Type 420, a straight-chrome hardenable stainless steel is the metal cast from the master pattern. This is a type that has already been widely used in plastic mold making in the wrought and machined form and has heat, abrasion and acid resistance necessary for the most exacting molding conditions.

In the as-cast condition this metal shows a hardness of Rockwell C 50-54 and has gone as high as 58, and has high compressive strength. Casting defects can be held under 0.005 in. on the molding surface and to plus or minus 0.003 in. on cavity dimensions and warpage.

While there is no limitation on detail in the mold cavity, present limitation on size is 5 x 9 in., with a cavity depth of 2 in. and a total weight of 12 lb. This is essentially a matter of equipment and not of metal characteristics.

Where much time and skill is required for locating positioning lugs and interlocks on master patterns, it is not advisable to cast cavity inserts. These can be left off the pattern and machined after casting. Where critical tolerances might be required on large castings they should be machined rather than cast.

The cycle for mold construction, outside of actual casting of cavity inserts, for the mold maker is: (a) Make master pattern with frame, (b) provide model from which master pattern was made, allowing for shrinkage, (c) furnish print of finished cavity or force, (d) machine outside of cavity blocks to fit the mold shoe, (e) stone the cavity, (f) harden, (g) polish. Castings are provided in a normalized and annealed condition.

After the stainless steel cavity block has been cast a stoning procedure is necessary to take out any minute regularities. Successively finer stones are used, starting with 120 grit for roughing and finishing with a 300 grit with chromium rouge. Kerosene

is used as a lubricant. Stoning under strong sunlight is not advised because the finish cannot be evaluated so precisely.

Hardening of the insert may be done in any good controlled-atmosphere furnace. It should be preheated in such a furnace to 110 F., then transferred to a salt pot running at 1500 F. The salt-bath method has been most effective in holding scale to a minimum. The salt pot and contents should then be raised to 1850 F. and held for 20 min. per in. of thickness. The work should then be quenched in oil at 125 F. and drawn at 375-550 F. for an hr, per in. of thickness. If the hardening is done properly, a very light finish stoning will complete the cavity.

In injection-molding practice, chamber heat in the machine has been limited to some extent by the frictional resistance of the cavity faces. The high heat resistance and relatively low frictional resistance of Type 420 stainless steel has enabled injection molders to run at a higher heat, plasticizing the material faster and shortening the molding cycle for higher production.

CASTING DESIGN

In designing the castings, the pattern is made with an allowance for shrinkage of 0.020 in./in. from finished-article size. This allows 0.006 in./in. for plastic shrinkage and 0.014 in./in. for stainless-casting shrinkage. The pattern must have no undercuts and a slight draft all over.

If the casting has a regular parting line, 1/16 in. is allowed on each side, end and face for finish machining. No allowance for machining the face is made if the parting line is irregular but a small bead is raised around the cavity edge. Forces do not have any allowance for machining on the parting line.

The master pattern is made to fit a metal frame, which must be light, easily dismantled but fairly rigid and should be 3/16 in. higher than the finished casting. This is an allowance made to cut the casting free from its base, after which there will be approximately 1/16 in. left on the back of the casting for finishing.

Frames may be designed round, square, or irregular, and may have parallel walls or walls which compensate for shoulders.

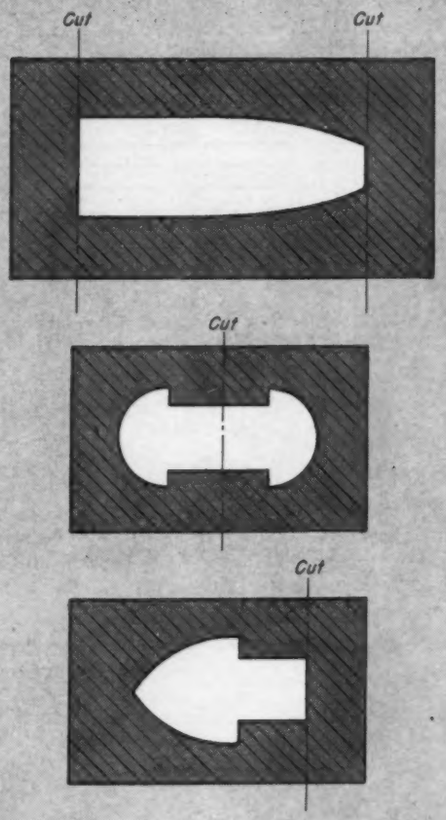
While the maximum wall thickness is about ½ in., ⅜ in. is preferable and if properly ribbed will withstand any conventional molding pressure. Where economy is mandatory, the cast stainless steel in ¼-in. walls and with ⅛-in. ribs will meet most pressure conditions.

Where thin flat castings are used, the forces should be cored from the back to provide a uniform wall. Where cavities are open on one or both ends, a temporary closure should be provided. The more irregular the parting line the more critical the coring and ribbing becomes.

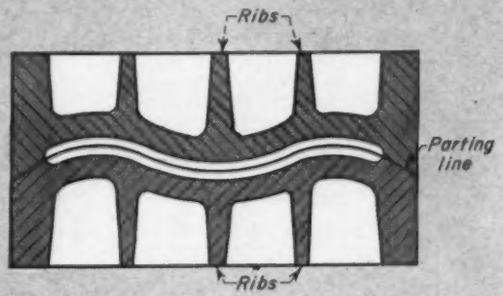
BACK-CORING DESIGN

Back patterns may be machined from brass steel, steel or laminated plastics and must be able to with-

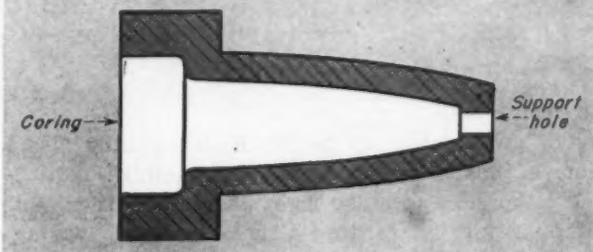
CASTING DESIGN



Cavity blocks which must have at least one end open must be cast with the end or ends temporarily closed. A good method, if length permits, is to put the cavities end-to-end and cut in half after casting

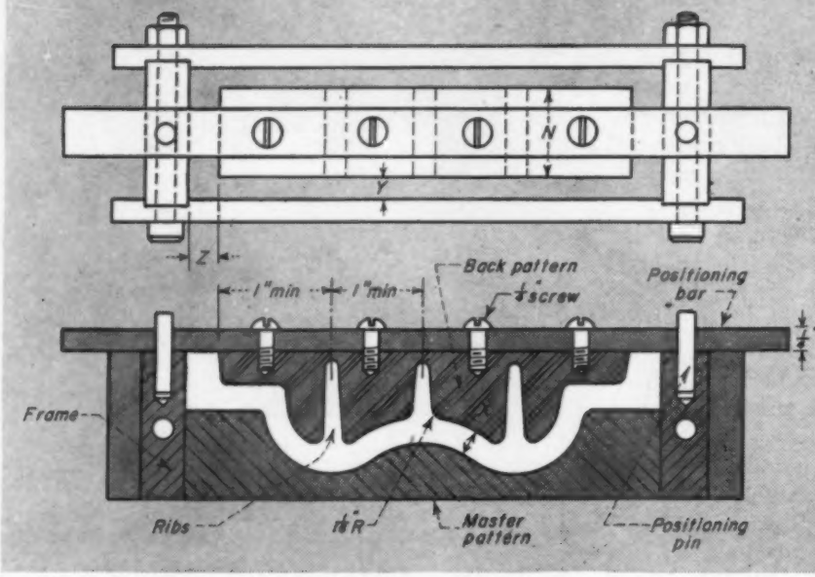


Both forces and cavity blocks must be back-cored and cross-ribbed where irregular parting lines are required



Long cast forces (more than length times the diameter) should have a hole through the small end to provide a support for the back coring

BACK-CORING PATTERNS



In designing back-coring patterns these points should be noted:

POSITIONING BAR — Should extend 2 in. each side of frame

POSITIONING PINS — Should be a sliding fit on the bar

SCREWS — Should be placed between each rib

RIBS — Should have 3/32-in. max. radius and 5° draft on a side. Ribs stop ⅛ in from the bar, and 3/16 in. is allowed on back of casting so the ribs will clean up. Center distance of ribs should be 1 in.

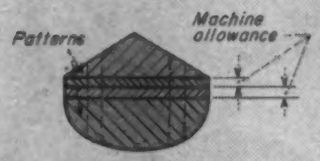
X — ⅜-in. wall generally used, must conform to face

Y — ¾-in. side wall generally used, must be less than Z

Z — ½-in. end wall, must be more than X

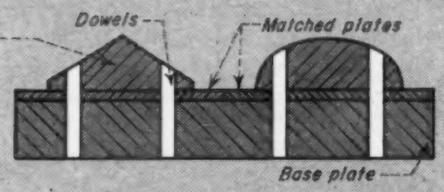
N — Widths over ¾ in. must be cross-ribbed

PAIRED CAVITIES

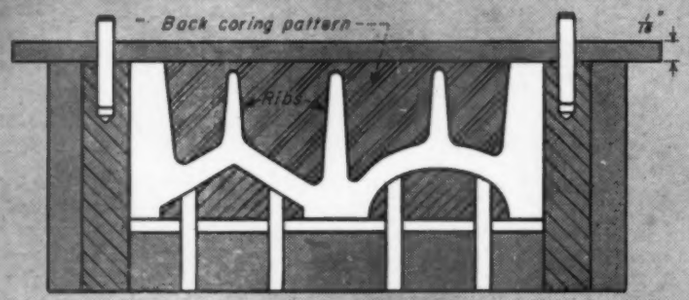


To make right and left cavities in the same casting, make a brass split pattern with an allowance to machine face in between and allowance for shrinkage

Mount patterns on top and bottom of a pair of 1/8-in. match plates, with dowels lining the parts and machine edge of match plates to size



Open up match plates and mount on 3/8-in. base plate, previously machined to combined size. Match plates should be carefully aligned with edge of base plate



Parts are assembled in a suitable metal frame, with 3/16 in. allowed for machining, and back coring patterns are made

stand temperature up to 300 F. They may also be made of plastic, cast by the sulphur method.

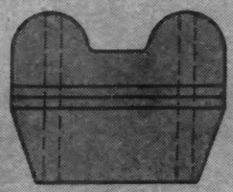
It is possible to make right and left cavities in the same casting by splitting a metal pattern, leaving a machining allowance on the face of each pattern. If cavities are small, as many as four can be grouped in the one cast insert, which cannot be done by the hobbing method.

Master patterns may be made by using a solid brass model, allowing for shrinkage. A rough cavity is machined out in the lower metal block which has been fitted in a frame. After the model is set into place, molten Cero-Base is cast into the unit to form the upper block. These will be used alternately with the model screwed into them to make the necessary cast insert.

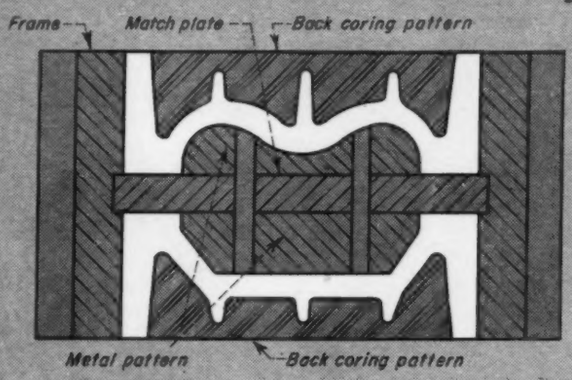
MATCHED-PLATE PATTERN

One of the most useful pattern setups is the match-plate pattern, in which numerous patterns may be

ONE-SIDED PATTERNS

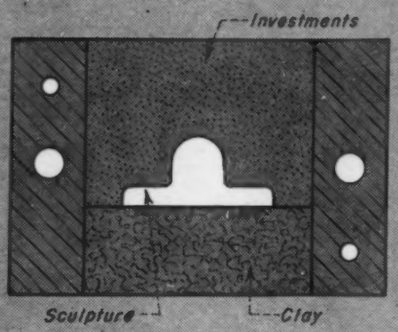


Patterns are split and suitably drilled, leaving an allowance for machining the face and for shrinkage. A metal frame is also made with a 3/8-in. thick match plate recessed into the frame

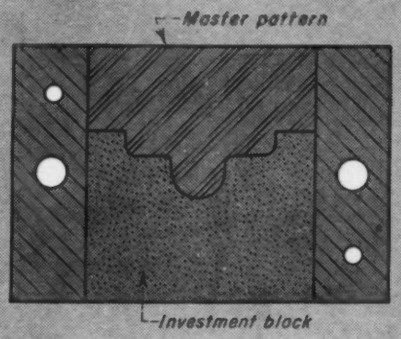


Patterns are mounted on the top and bottom of the match plate, allowing dowels to go through the plate to patterns. Sweat, rivet or screw the patterns in place and make the back-coring patterns in the manner shown. Numerous patterns may be mounted side by side to provide multiple-cavity castings

MATCH-PLATE PATTERN

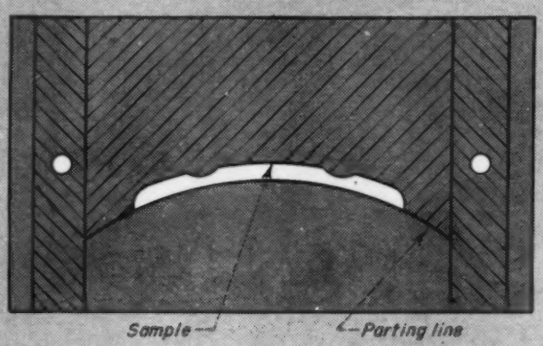


Plaster model or sculpture is mounted on modeling clay in a metal frame and the remainder of the frame is filled with gray dental investment

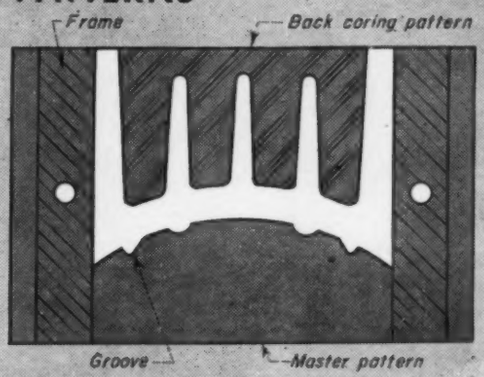


After investment has been dried and cooled and the frame inverted, molten Cero-Base is poured in to form the master pattern. It is cleaned and polished and a back-coring pattern is made

CURVED MASTER PATTERNS



Dental model plaster is poured in to clear the high point of the parting line, and the plaster block cut to correct parting-line shape. A plastic model or sample is used and cemented in correct position, and the investment is poured



The investment block is placed in the frame, and the pattern cast with Cero-Base. The pattern is then cleaned up, a groove scraped around the cavity and the back coring pattern conventionally made as shown

mounted side by side on the match plate to give multiple-cavity cast cavity inserts, each cavity being an exact duplicate of its corresponding cavity.

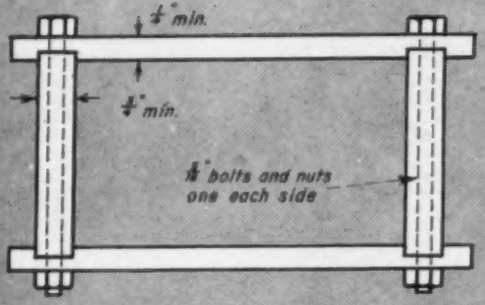
ONE-SIDED PATTERNS

A sculptured model of plaster may be easily adapted to making one-sided master patterns. The sculpture is mounted on modeling clay in a metal frame to give the correct height of the finished stainless casting, plus 3/16 in. The sculpture and clay is lubricated with cut green soap, and dental investment material is cast into the void, using a vibrator. The investment block is then dried overnight at 200 F., cooled to room temperature or slightly chilled.

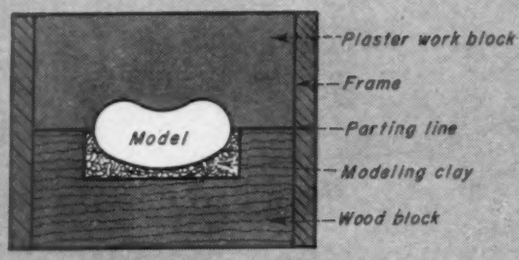
The investment block is inverted in a metal frame and molten Cero-base is poured in to form the master pattern with a vibrator. After it is removed from the frame, the master pattern is cleaned and polished on the face and touched up for details.

Plastic samples of the product may be used to

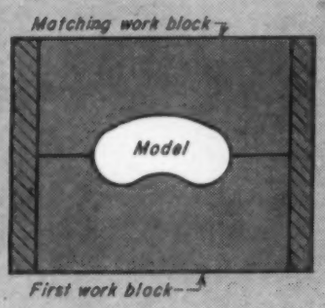
HOLLOW-PART PATTERNS



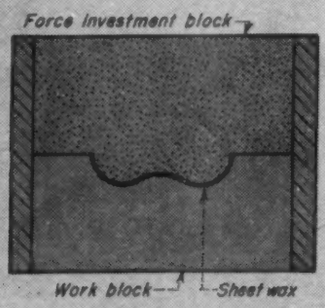
Allowance is made for shrinking and finishing in this frame for making a master pattern from a solid model, to be used when a hollow plastic product is required



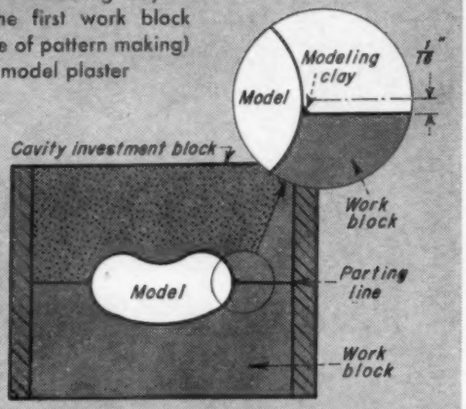
After sinking the model in modeling clay to establish parting line, the first work block (four required for this type of pattern making) is cast from dental model plaster



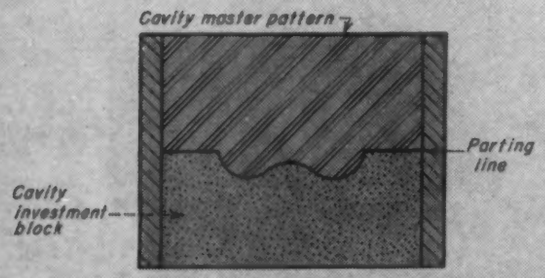
The wood block and modeling clay are taken out of the frame, which is then inverted for casting the matching working block in sequence



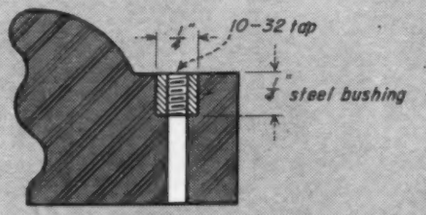
Sheet wax is used to build up the required wall thickness (of the hollow plastic part to be subsequently molded, and the force block is cast from dental investment



The model is put back again for casting of the cavity blocks, and a 1/32-in. fillet of modeling clay is placed around the model before casting the cavity investment blocks, using a green soap lubricant



After the investment blocks have cooled they are placed one at a time in the frame and molten Cero-Base is cast against them



This procedure provides four accurate metal master patterns and a metal frame, which with the addition of back coring is the setup for casting the required stainless-steel mold inserts for a hollow plastic product. Here ejector screws are added after machining the back

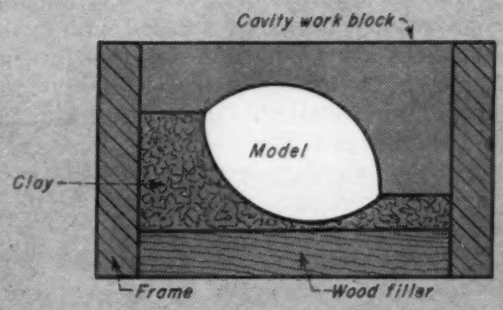
make curved master patterns. Dental model plaster is cast into a metal frame in an amount sufficient to clear the high point of the parting line. The plaster block is cut to correct parting-line shape and the plastic sample mounted in position with rubber cement. The investment is poured, allowed to dry overnight, then placed in ice to chill for 10 min. The master pattern is cast with molten Cero-base.

The pattern is cleaned up and a small groove cut around the edge of the cavity to provide a sharp corner after fitting. The back coring pattern, which is essential on irregular parting line castings, is made in the manner already described.

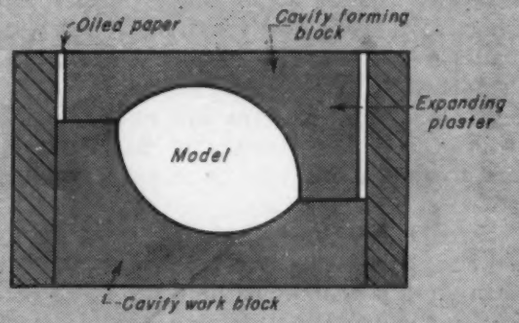
PATTERN FOR HOLLOW PARTS

A widely used pattern for molds involving hollow plastic products may be made from a solid model, which can be made of plaster, plastic or metal. On all plaster work, green soap cut with alcohol should be used as lubricant.

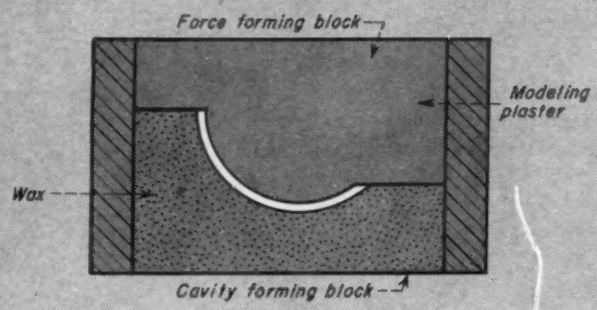
LARGE PATTERNS



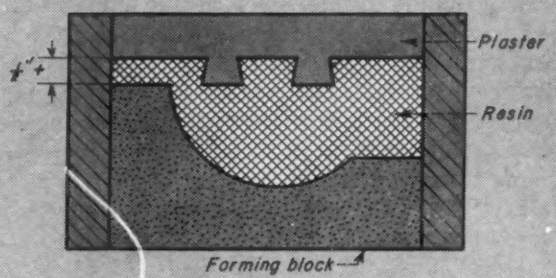
Where retention of detail is important in large molded products but finished size is not too close this method of making patterns will keep costs down. The model, nonmetallic, is imbedded in modeling clay in a metal frame 3/8 in. higher than the total finished heights of cavities



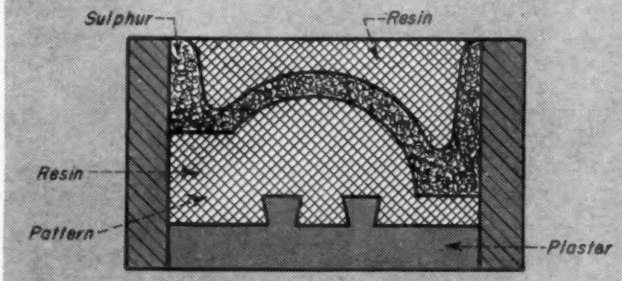
Expanding plaster is cast against each work block and oiled paper is used to build up the walls to required dimensions determined by intermittent measuring



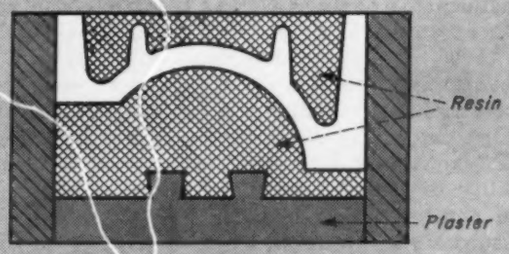
Wall thickness for the required plastic product is built up by sheet wax before casting the force forming block from model plaster



With one forming block in place, and the frame assembly still warm, liquid resin is cast in the frame to about 1/2 in. higher than highest point of the forming block and cured. Large undercuts may be made in the back of the plastic pattern and plaster cast in back of it, filling the balance of the frame to density sufficient for strength



Molten sulphur is poured into the assembled frame and pattern, allowed to stand for a minute, then poured off. This is repeated until required wall thickness is built up. While the unit is warm, the back-coring pattern is cast from plastic resin, and the cycle is repeated four times



Sand-draft and add ribs to the coring pattern as previously described. Domed-shaped patterns, however, do not require ribs. This method may be used for forming back-coring patterns with other types of master patterns where the coring would be too difficult to machine

The model is imbedded in a metal frame to establish parting line, and the first work block is cast from dental model plaster. The wood block and modeling clay is removed, the frame inverted and a matching work block is cast. Wall thickness is built up in each work block with sheet dental wax. Force investment blocks may be cast with good dental wax.

If the parting line is flat 1/16 in. should be machined off the face of the work blocks. This allows 1/16 in. to machine on the finished cavity and allows the cavity much greater freedom. If the parting line is irregular no machining is required.

The model is replaced, and if stock has been removed, a 1/32-in. fillet is built up around the model with modeling clay and investment blocks cast, the soap lubricant being used at each step. The four investment blocks are then dried in a gas oven at 200 F. for 12 to 14 hr.

After reaching room temperature, the blocks are replaced one at a time in the frame and molten Cero-

base cast against them. Cavity master patterns always cast easily, but some shapes of force master patterns will require 10 min. chilling at sub-zero temperatures to give a smooth cast.

Faces of the patterns are cleaned and polished with a fine brass wire brush. Backs of the patterns are machined and two or three ejector screws are added at even spacings.

Some large objects, where high precision is not required but retention of detail is more important than strictly maintained dimensions, do not warrant the cost of metal patterns. A method may be used which will give a plastic part approximately 0.014 in. smaller than the original model but with exact reproduction of detail.

After the model has been imbedded in modeling clay and the parting line established, dental model plaster is cast to form the cavity work block. Clay is removed, the frame inverted the opposite work block cast from model plaster against the first work block with the model. The sides of the frame are built up with oiled paper to equal 0.014 in. per in. of length and width of the frame. Expending plaster is cast against each work block to make two cavity-forming blocks. Wall thickness of sheet wax is built into cavity-forming blocks and model plaster is cast to form force-forming blocks.

All working surfaces of both cavity-forming blocks and force-forming blocks are painted with synthetic paint (such as Larcoloid) and air-dried overnight. The frame is assembled with one cavity-forming block in position. While the unit is still around 140 F., liquid resin is cast into the void to approximately ½ in. higher than the peak point of the forming block, and allowed to cure without removing the form blocks. This is repeated with the other forming blocks to give a total of four plastic master patterns.

While the patterns are still warm they are scrubbed with paint solvent and brush and replaced into forming blocks where plaster is cast in back of the pattern to fill up the balance of the frame. Large undercuts should be made in the back of the plastic patterns so they will adhere tightly to the plaster back of the blocks.

The frame is assembled with the pattern in place and is poured full of molten sulphur, which is held there for 1 min. and poured out. The unit is cooled to room temperature and the procedure repeated, cooling in between each pouring until the required wall thickness has been built up. While the unit is still warm, the back-coring pattern is cast with liquid resin. As soon as the resin starts to set, the sulphur shell and resin is placed in an oven and cured. This is repeated for the four coring patterns.

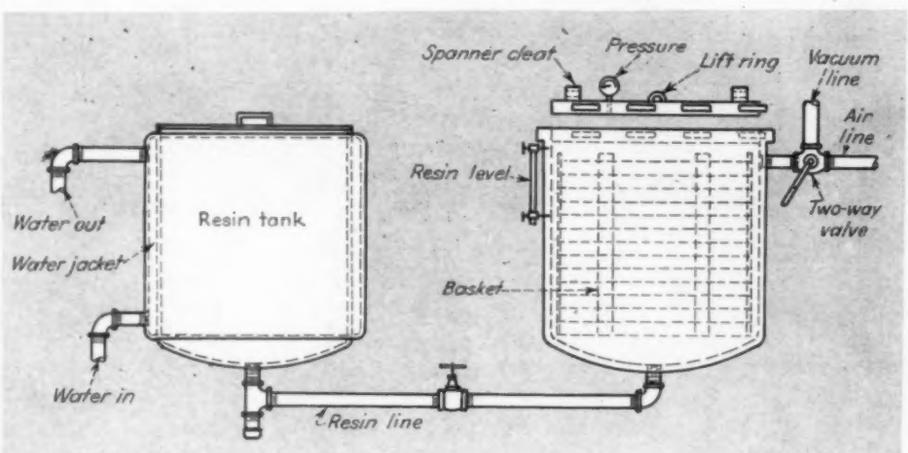
PLASTIC RESIN SEALS POROUS CASTINGS

MANY CASTINGS in use today must be free of micro-porosity for functional purposes as well as being both water- and pressure-tight. However, micro-porosity does not show up sometimes until the casting has assimilated all foundry costs and a high percentage of machining cost —or when it fails in service. This possibility of leakage in both ferrous and non-ferrous castings can be substantially reduced by a thermosetting polyester resin.

Castings showing microporosity can be treated by putting them in a vat and allowing the resin to penetrate by internal pressure or by impregnating them under vacuum pressure. The latter method is better and is almost always used where a considerable number of castings are involved.

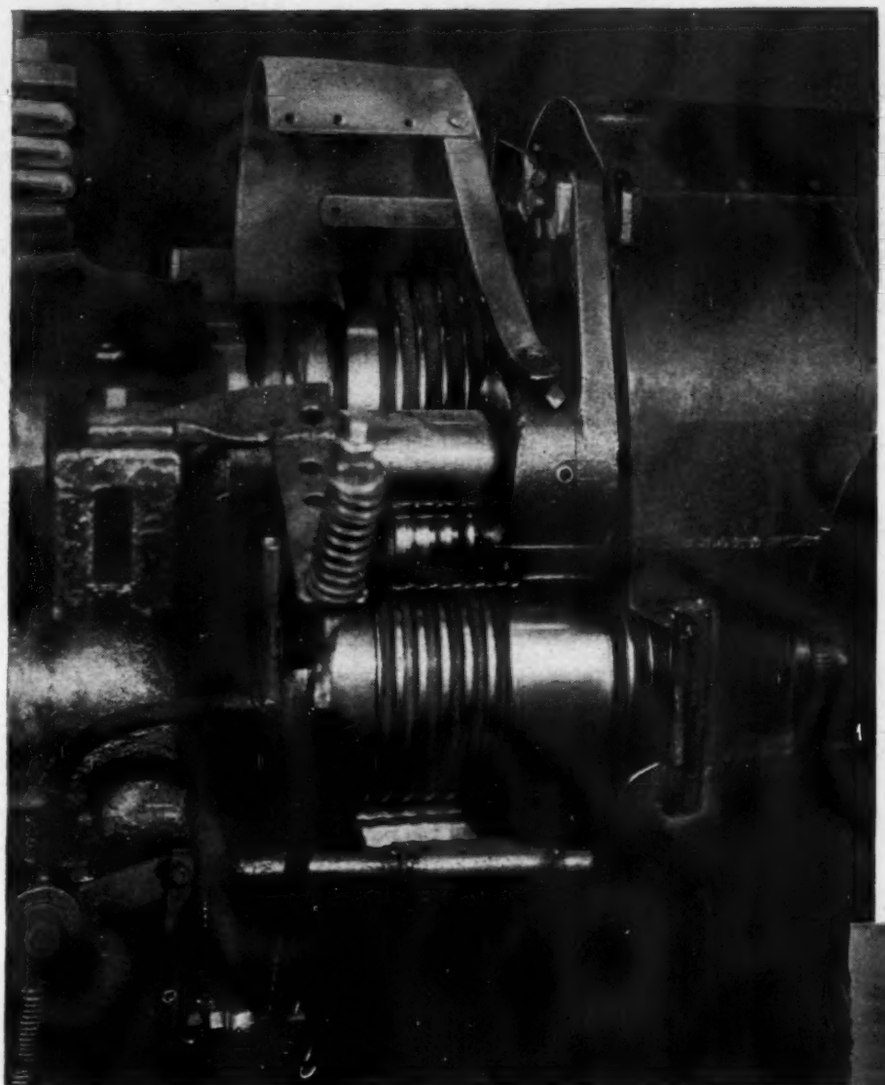
Before the war tung oil was used for this purpose but it was cut off and a number of different plastic resins were used in an effort to combat porosity, particularly in the light metals for aircraft use. The present resin is sold as a colorless liquid and when catalyzed with a peroxide and subjected to heat, polymerizes to form a thermosetting solid. Viscosity can be varied to satisfy a broad range of requirements and ensure a proper flow into the pores of the castings.

Castings should be machined before impregnation as this opens up the pores which would otherwise be sealed by the outer skin of the casting. The castings are then cleaned by conventional solvent methods and inspected, and preheated to 250 F. to drive off cleaning solvents and eliminate any trapped gases. Impregnation is not meant to be a medium of salvaging castings which are known to have foundry flaws, cracks and blowholes.



Vacuum pressure is the best method of impregnating porous castings with resin, being faster and more economical in the long run than other methods

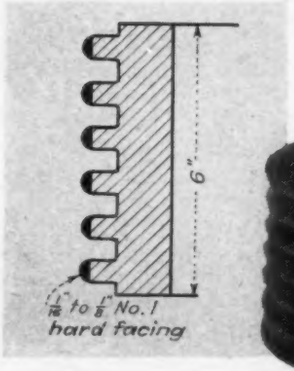
Hard-faced Dies Make Drums



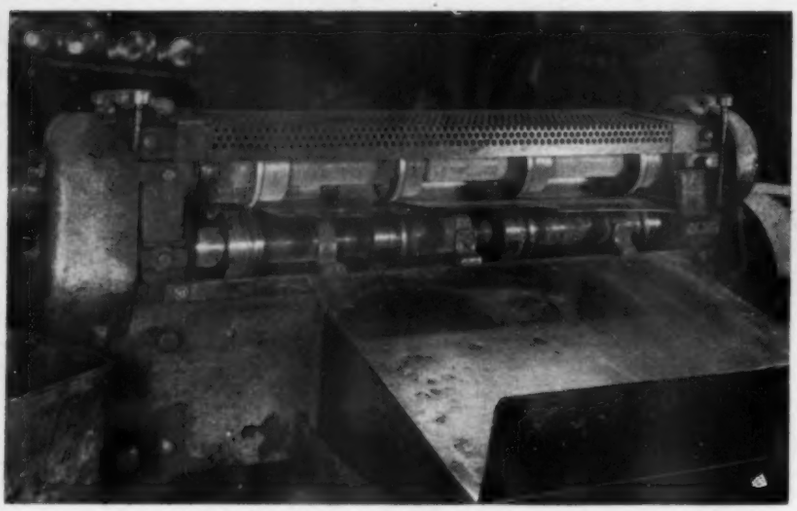
During their lifetime these corrugating rolls, hard-faced with No. 1 rod, produce 15 million 26-gage sheet-steel drum bodies

BY JOHN A. GALLAHER
HAYNES STELLITE COMPANY

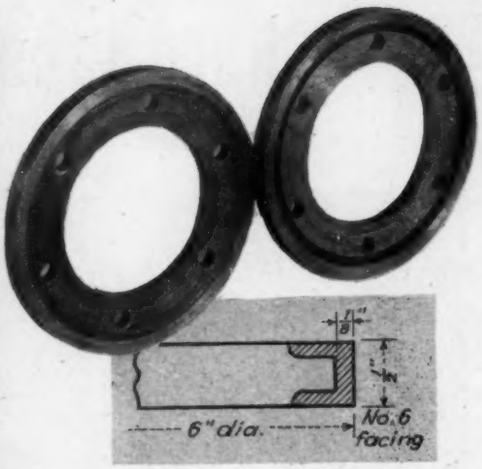
RECORD PRODUCTION has been attained with hard-faced forming and cutting tools in fabrication of steel containers for dry materials. As a consequence, practically every operation performed on drum parts is done with tools hard-faced with No. 1 or No. 6 Haynes Stellite alloy welding rod applied with the oxyacetylene blowpipe. In a few cases, solid forming tools made from one of these alloys are used. Cost of these tools averages 25 to 30% higher than that of similar tools made from hardened tool steel, yet wear life between reconditionings is increased several times, reducing machine down time and tool inventory. Further, worn tools, instead of being replaced, need only to be hard-faced again and reground.



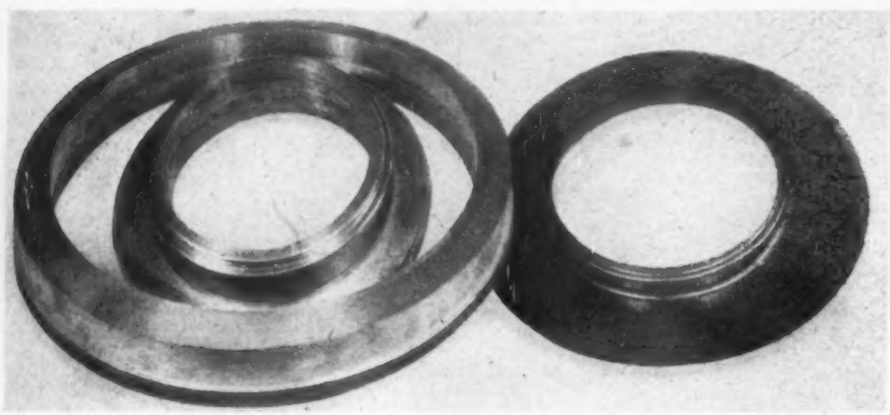
THESE CORRUGATING ROLLS form the 100-lb. drum behind them. Similar ones make 25-, 300- and 400-lb. sizes. Rolls are low-carbon steel, with the ridges faced with 1/8 in. of No. 1 alloy, as shown in the inset sketch, and are preheated to assist hard-facing. Tools are ground to required dimensions



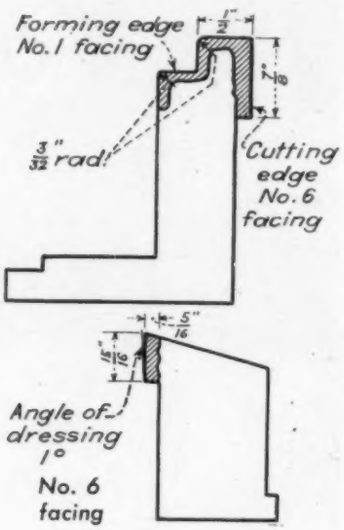
FOUR PAIRS OF WHEELS slit 28-gage sheet steel for drum bottoms and seals. Similar wheels slit 30-gage sheet steel. During their life, hard-faced slitting wheels make half a million cuts, each 84 in. long

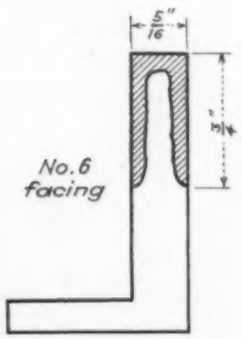


THESE HARD-FACED WHEELS slit 26- and 30-gage steel sheets for drum bottoms and seals. No. 6 rod is applied to the perimeter and each side of the wheels. Resharpening is necessary once a year

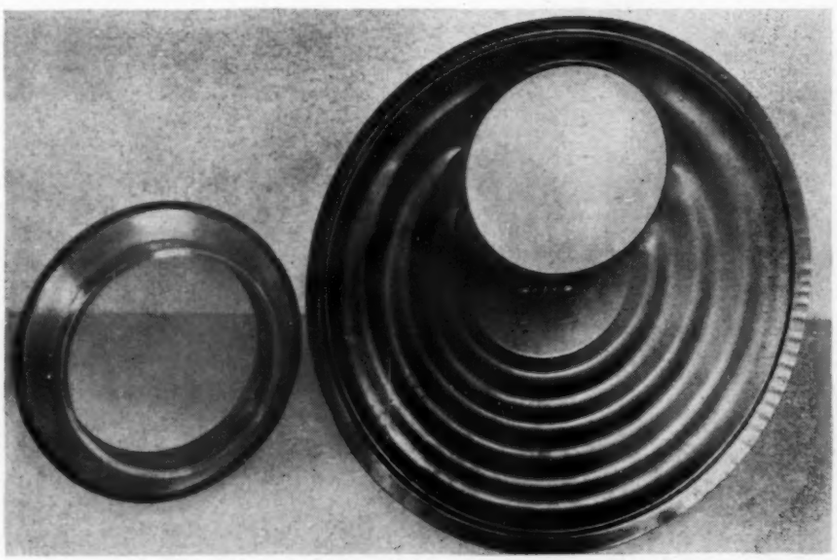


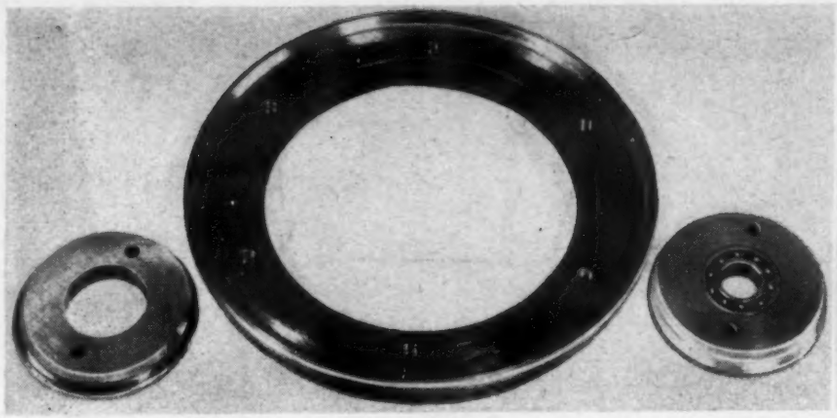
SMALL PRESS DIE RING at left cuts and forms 26- or 28-gage sheet steel for the 100-lb. drum top (right). Useful life is nearly 1,000,000 pieces. The larger ring, used simultaneously in the same press operation, cuts the 14 3/16-in. O. D. of the part. Useful life is almost 1,900,000 parts. Both rings are hard-faced as shown in sketches, the smaller ring with two grades

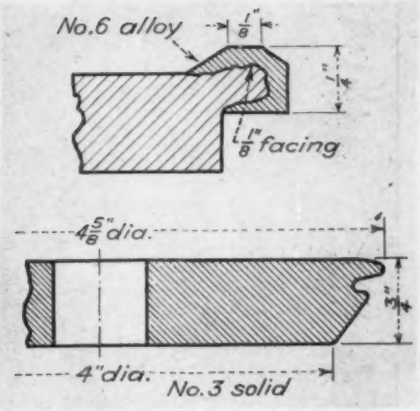




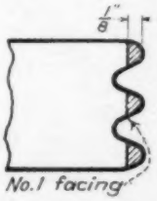
HARD-FACED DIE at left pierces plug openings in larger drum tops of 24- and 26-gage sheet steel. Its average performance is over one million parts each time it is hard-faced. Drum top at right has been pierced with this die

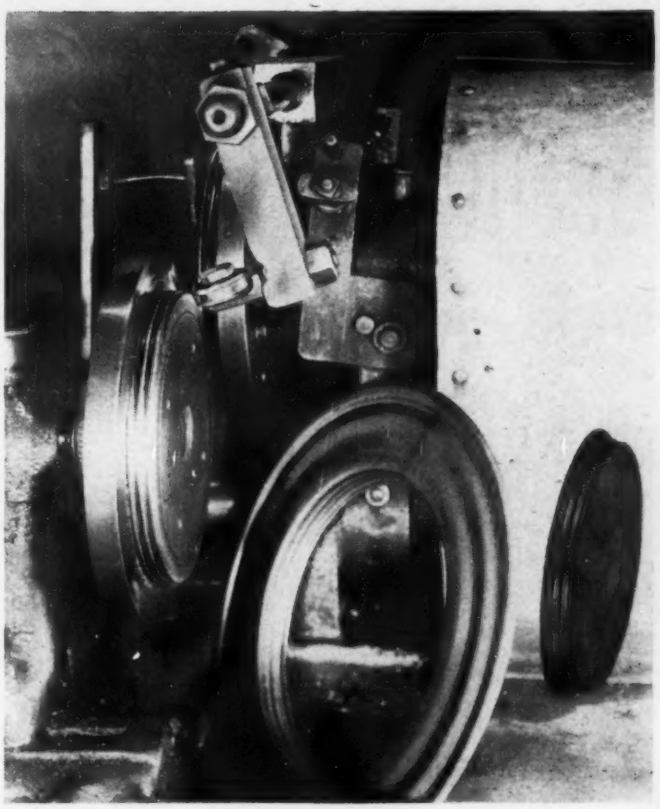




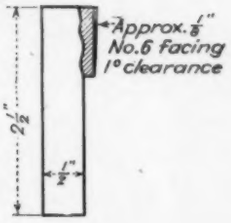


LARGE RING in center is a double seamer head, while smaller wheels are first- and second-operation seaming wheels. The large ring is a mandrel against which the smller wheels force the 28- or 26-gage drum side into a seam with drum cover or bottom. During the lifetime of the hard-faced larger wheel (sketch), about 630,000 seams are formed. The smaller wheels are solid No. 3 alloy (sketch), and are good for about 950,000 seams on 100-lb. capacity drums. When these small seaming wheels are worn badly, they are reground and used on drums of larger diameter





HARD-FACED THREADING RINGS for drum tops and screw covers are mounted in the forming machine. The finished part in foreground is a drum top into which the screw cover (right) fits. Both are 28-gage sheet. Only rolling surfaces are faced, as sketched. During life of these die rings, approximately 2,846,000 pieces are produced. Rings are dressed only once during that time



BOTTOM BLADE of this shear has been hard-faced with No. 6 alloy. It shears 26-gage steel, 58¾ in. long, for 400-lb. drum bodies. Profile of the 62-in. blade is sketched. The blade has cut more than one million body sheets, looks good for at least 400,000 more before refacing

Unit Measurement X	Average minus Unit Measurement $\overline{X}-X$	Deviation d	d^2
1.6890	1.6892 − 1.6890 =	+ 0.0002	0.00000004
1.6896	1.6892 − 1.6896 =	− 0.0004	0.00000016
1.6893	1.6892 − 1.6893 =	− 0.0001	0.00000001
1.6886	1.6892 − 1.6886 =	+ 0.0006	0.00000036
1.6893	1.6892 − 1.6893 =	− 0.0001	0.00000001
			0.00000058 = Σd^2
			$\frac{\Sigma d^2}{N}$ = 0.0000001160

$\sigma = \sqrt{0.0000001160} = 0.00033$

Fig. 9—Standard deviation can be calculated in tabulated form from differences of unit measurements and the average. Extracting the square root of the sum of the differences squared divided by sample size gives the standard deviation

Quality Control Aids Supervisors . . . 4

Measure of Variation

Quality of manufactured parts can generally be controlled by using $\overline{X}$ and R charts, but unusual conditions may demand σ charts

BY DAVID T. ARMSTRONG

TO COMPARE two groups of statistical data, the following are essential: (1) an average and (2) a measure of variability from the average.

Next in importance to the average is the deviation, which is a measure of variation of a distribution from the average found. As there will be variation both above and below an average, the deviation variation is designated as $\pm d$.

The average eliminates the necessity of stating all measurements from which it was derived. The deviation, by a single figure, indicates the extent to which other values cluster about or are dispersed from the average found. Thus, for all practical purposes, any series of measurements can be summarized by the two figures: average, plus or minus the deviation, or $A \pm d$.

There are, of course, other measures of variability or dispersion, such as the quartile deviation Q, the mean deviation $A\ D$, median deviation or probable error $P\ E$, and the standard deviation σ. It is this latter measure, the standard deviation, with which statistical quality control is concerned as it gives more weight to extreme cases than any other comparable measure of variability.

The standard deviation σ is the square root of the arithmetic mean of the squares of the deviations from the average. This is sometimes written as the equation

$$\sigma = \sqrt{\frac{(d_1)^2+(d_2)^2+(d_3)^2 \ldots +(d_N)^2}{N}}$$

where $d_1, d_2 \ldots d_N$ are the deviations of the measurements from the average chosen.

A more expanded form of this equation would be

$$\sigma = \sqrt{\frac{(\overline{X}-X_1)^2+(\overline{X}-X_2)^2 \ldots (\overline{X}-X_N)^2}{N}}$$

where $\overline{X}$ is the average and the $X_1, X_2, \ldots X_N$ are the measurements of the unit pieces.

These equations may be abbreviated to the mathematical formula

$$\sigma = \sqrt{\frac{\Sigma d^2}{N}}$$

Meaning of Standard Deviation

Photographers enlarge small prints to study a picture for any small significant details. Statisticians do the same thing. The photographer uses equipment, such as the enlarger. The statistician uses mathematical equipment, such as the formula for standard deviation.

The purpose is the same: to amplify or enlarge by some means the actual measurements made of unit pieces in order to analyze carefully a batch of work. Standard deviations will indicate, more clearly than any other single measurement, the homogeneity of quality or the lack of quality in a batch of pieces.

Up to this point, average and range have been applied to make excellent analyses of quality-control charts. But there are limitations to the average and the range. The average indicates the size of the normal piece, the most common measure-

ment of all workpieces in a batch. But it does not show whether there are few or many pieces which cluster around the average.

Similarly, the range indicates the difference between the smallest and largest pieces produced, but it does not show whether the pieces cluster around the largest or the smallest piece.

The standard deviation does show this by indicating a range of variation on either side of the average. When the standard deviation is small, the pieces cluster close to the average. When the standard deviation is large, the pieces do not cluster quite so close around the average, but are spread over the entire range of the distribution.

In a group of pieces produced to 0.750 in. ± 0.003, there will be a few pieces 0.747 in. and a few pieces 0.753 in. But if the distribution is nearly normal and the quality control is high, the great majority of the pieces will be 0.750 in., or fairly close to it, and about 68% of all pieces will lie between the limits 0.749 to 0.751 in.

It is a generally true tendency, much observed by shop men, that most batches of manufactured goods, where a norm has been set up, tend to center around an average size and to be homogeneous and consistent.

Control limits for averages, discussed in connection with the average range and the probability constants in Table I, are easier to understand and calculate, and are more rigid than standard-deviation limits. For practical purposes, it is from one point of view better to deal with averages and ranges and average control limits in the shop, and leave the standard deviations to the quality-control engineer.

Charts for averages and ranges are generally sufficient for routine shop operations. When an examination of averages or the trend of averages indicates unusual conditions, it is then time to call in the quality-control engineer and have him apply the mathematical tools to calculate standard deviations by rigid statistical analyses.

Standard-Deviation Calculations

The original data for obtaining a standard deviation is the working data sheet of Fig. 4 (Part 2 of this series).

The lack of control for batches 1 and 2, as indicated by the unit measurements of pieces from sample lots 1 and 2, suggests the need for statistical analysis. If it is not desirable or feasible to subject batches 1 and 2 to 100% inspection, the application of standard deviations to the averages will indicate how many pieces of the entire batch are likely to be acceptable.

In Fig. 4, averages for sample lots of five pieces were calculated and then averaged to obtain the grand average. Similarly, standard deviations for sample lots of five pieces are calculated and then averaged to obtain the average standard deviation $\bar{\sigma}$. (See sample lot 1, below.)

Actually, however, calculations are never performed as here indicated. The tabulation shown in Fig. 9 is a much simpler method of obtaining the same results in the following steps:

1. Column 1 is the unit measurement, or X.
2. Column 2 is the difference between the average of the sample lot and the individual unit measurement, or $\bar{X} - X$.
3. Column 3 is the numerical difference between the average and the unit measurement squared.
4. Column 4 is the numerical difference between the average and the unit measurement squared, or
5. The addition of column 4 gives Σd^2, or 0.00000058.
6. Dividing the sum of column 4

For sample lot 1, σ

$$= \frac{(\bar{X}-X_1)^2+(\bar{X}-X_2)^2+(\bar{X}-X_3)^2+(\bar{X}-X_4)^2+(\bar{X}-X_5)^2}{5}$$

$$= \frac{(1.6892-1.6890)^2+(1.6892-1.6896)^2+(1.6892-1.6893)^2+(1.6892-1.6886)^2+(1.6892-1.6893)^2}{5}$$

$$= \frac{(0.0002)^2+(0.0004)^2+(0.0001)^2+(0.0006)^2+(0.0001)^2}{5}$$

$$= \frac{0.00000004+0.00000016+0.00000001+0.00000036+0.00000001}{5}$$

$$= \frac{0.00000058}{5} = 0.0000001160 = 0.00033$$

Sample Lot No.	Piece No.	Unit Measurement X	Average minus the Unit Measurement $\bar{X}-X$ or Deviation d	d^2		Sample Lot No.	Standard Deviation σ
1	1	1.6890	0.0002	0.00000004	$\Sigma d^2 = 0.00000058$	1	0.00033
	2	1.6896	4	16	$\frac{\Sigma d^2}{N} = 0.0000001160$	2	0.00022
	3	1.6893	1	1	$\sqrt{\frac{\Sigma d^2}{N}} = 0.00033$	3	0.00011
	4	1.6886	6	36	$\sigma = 0.00033$	4	0.00021
	5	1.6893	1	1		5	0.00021
	Av.	1.6892		58		6	0.00011
						7	0.00034
2	1	1.6901	0.0000	0.00000000	$\Sigma d^2 = 0.00000025$	8	0.00011
	2	1.6901	0	0	$\frac{\Sigma d^2}{N} = 0.0000005$	9	0.00017
	3	1.6901	0	0	$\sqrt{\frac{\Sigma d^2}{N}} = 0.00022$	10	0.00026
	4	1.6898	3	9	$\sigma = 0.00022$	11	0.00014
	5	1.6905	4	16		12	0.00016
	Av.	1.6901		25		13	0.00011
						14	0.00002
3	1	1.6874	0.0001	0.00000001	$\Sigma d^2 = 0.00000007$	15	0.00029
	2	1.6873	0	0	$\frac{\Sigma d^2}{N} = 0.000000014$	$\Sigma\sigma$ =	0.00279
	3	1.6874	1	1	$\sqrt{\frac{\Sigma d^2}{N}} = 0.00011$	Average Standard Deviation or $\bar{\sigma}$ =	0.000186
	4	1.6874	1	1	$\sigma = 0.00011$		
	5	1.6871	2	4			
	Av.	1.6873		7			

Fig. 10—Calculation of the standard deviation is simplified by eliminating decimal places in working with deviation values. The average standard deviation $\bar{\sigma}$ is the numerical average of the sigmas given in the last column

PART SIZE - 4.344 in. ± 0.010

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	4.340	4.366	4.336	4.356	4.335
2	4.331	4.366	4.342	4.358	4.338
3	4.336	4.366	4.340	4.358	4.340
4	4.337	4.367	4.340	4.352	4.339
5	4.332	4.363	4.339	4.354	4.340
Total	21.676	21.828	21.697	21.778	21.702
$\bar{X}$	4.3352	4.3656	4.3392	4.3556	4.3402
σ	0.0071	0.0033	0.0044	0.0053	0.0054
R	0.009	0.004	0.004	0.006	0.005

	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
1	4.339	4.340	4.342	4.342	4.337
2	4.336	4.338	4.340	4.344	4.332
3	4.336	4.336	4.343	4.345	4.333
4	4.333	4.340	4.341	4.341	4.336
5	4.332	4.341	4.340	4.345	4.339
Total	21.676	21.695	21.706	21.717	21.677
$\bar{X}$	4.3352	4.339	4.3412	4.3434	4.3354
σ	0.0055	0.0040	0.0026	0.0037	0.0058
R	0.007	0.005	0.003	0.004	0.007

	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
1	4.345	4.346	4.340	4.342	4.329
2	4.346	4.348	4.356	4.346	4.328
3	4.346	4.345	4.343	4.344	4.342
4	4.348	4.346	4.349	4.343	4.328
5	4.347	4.347	4.350	4.342	4.327
Total	21.732	21.732	21.738	21.717	21.654
$\bar{X}$	4.3464	4.3464	4.3476	4.3434	4.3308
σ	0.0024	0.0024	0.0118	0.0034	0.0127
R	0.003	0.003	0.016	0.004	0.015

Sample	$\bar{X}$	R	σ
1	4.3352	0.009	0.0071
2	4.3656	0.004	0.0033
3	4.3392	0.004	0.0044
4	4.3556	0.006	0.0053
5	4.3402	0.005	0.0054
6	4.3352	0.007	0.0055
7	4.3390	0.005	0.0040
8	4.3412	0.003	0.0026
9	4.3434	0.004	0.0037
10	4.3354	0.007	0.0058
11	4.3464	0.003	0.0024
12	4.3464	0.003	0.0024
13	4.3476	0.016	0.0118
14	4.3434	0.004	0.0034
15	4.3308	0.015	0.0127
Total	65.1446	0.095	0.0798
	$\bar{\bar{X}}$ 4.3429	$\bar{R}$ 0.0063	$\bar{\sigma}$ 0.0053
	Control Limits		
UCL	4.3468	0.0143	0.0112
LCL	4.3392	0	0

Fig. 11—This type of working data sheet not only shows averages, ranges and standard deviations but also gives their upper and lower control limits — all data needed for plotting of *X*, *R* and σ charts

QUALITY CONTROL AIDS SUPERVISORS (Continued)

by 5, the number of workpieces measured, gives $\frac{\Sigma d^2}{N}$, or $\frac{0.00000058}{5}$ = 0.0000001160.

7. The square root of $\frac{\Sigma d^2}{N}$ gives the standard deviation, or sigma, 0.00033 for sample lot 1.

In actual practice having so many zeros in a decimal is confusing, particularly after squaring it. Fig. 10 shows a simplified method of setting down the data, and facilitates the addition and calculation.

The data in the last column are simply the sigmas of the various sample lots. Since there were 15 sample lots in the original data on the working data sheet in Fig. 4, there are 15 sigmas here. These 15 sigmas have been added and the average sigma calculated for the entire day's work under consideration in Fig. 4.

When the figures are simple as they are here, calculation of the square of the difference and extraction of the square root are relatively easy. However, they are seldom so easy, and most quality-control men become sufficiently adept in the use of a slide rule to square the numbers and extract the roots for the solution of the equation.

Fig. 11 shows another method for accumulating quality-control data. This chart is more complete than the one shown in the earlier article and indicates averages, ranges and sigmas, as well as upper and lower control limits for the average, range and standard deviation. This is the recommended type of chart because it is highly informative, simple and compact.

Sigma of the Sigma

In connection with the average and range, their reliability were calculated by using the probability constants from Table I. Similarly, reliability of the sigma can be calculated. This means in effect calculating the sigma of the standard deviation.

The upper control limit is found by the formula $B_4\ \sigma$, and the lower control limit is found by the formula $B_3\ \sigma$. Table I gives B_4 as 2.128 for 5 unit pieces and B_3 as 0. Thus, the upper control limit is 2.128 × 0.0053, or 0.112 and the lower limit is 0.

These are considered more reliable than the range control limits and indicate more clearly the performance behavior of the machine. But this type of highly refined measurement is of more value to the quality-control expert than to the man in the shop. Whether to use σ or *R* chart depends to great extent on the size of sample lot. A practical working rule is to use $\overline{X}$ and σ charts rather than $\overline{X}$ and *R* charts whenever the sample-lot size is greater than fifteen. As the lot size increases, the advantage of using standard deviation as a measure of dispersion increases.

Fig. 12 gives the $\overline{X}$, *R* and σ control charts plotted from the data in Fig. 11. A study of the charts shows an extreme lack of control and the necessity of making corrective adjustments to remove the assignable causes of variation. No definite rule can be made regarding proper action to be taken when a process shows lack of control, because each case differs from others and decision should be based on economic and case factors. But regardless of particular case, action should be taken by someone, whether quality-control engineer, foreman or operator, who understands both basic principles of quality control and the process under study.

As explained previously, the purpose of this series of articles is only to present fundamentals and to give the supervisor an understanding sufficient to enable him to apply in the shop the methods of statistical quality control. As the $\overline{X}$, *R* and σ charts, that is, the charts for vari-

ables, are by far the most widely applied, no mention has been made of the other control charts—the fraction defective or *p* chart and the defects or *c* chart.

The *p* chart has the same objective as the $\overline{X}$ and *R* charts—to disclose the presence of assignable causes of variation, but it does not have as great diagnostic value. When quality characteristics can be, or are, measured only as attributes, such as with "go" and "not-go" gages, rather than as actual dimensions, *p* charts are substituted for variable charts to improve quality of product.

The control chart for defects, or *c* chart, is much more limited in use. It can be applied effectively when all defects must be eliminated following 100% inspection and to determine adherence of lots to within the tolerable number of defects.

As these articles have provided the supervisor with a foundation on which further knowledge of statistical quality control can be built, the following are recommended for the man who wants to extend his know-how in this important phase of production:

American War Standards Z 1.1-1941 and Z 1.2-1941, "Guide for Quality Control and Control Chart Method of Analyzing Data" and Z 1.3-1942, "Control Chart Method of Controlling Quality During Production"—American Standards Association.

Dodge and Romig—"Sampling Inspection Tables — Single and Double Sampling," John Wiley & Sons, Inc., 1944.

Freeman, H. A.—"Industrial Statistics," John Wiley & Sons, Inc., 1942.

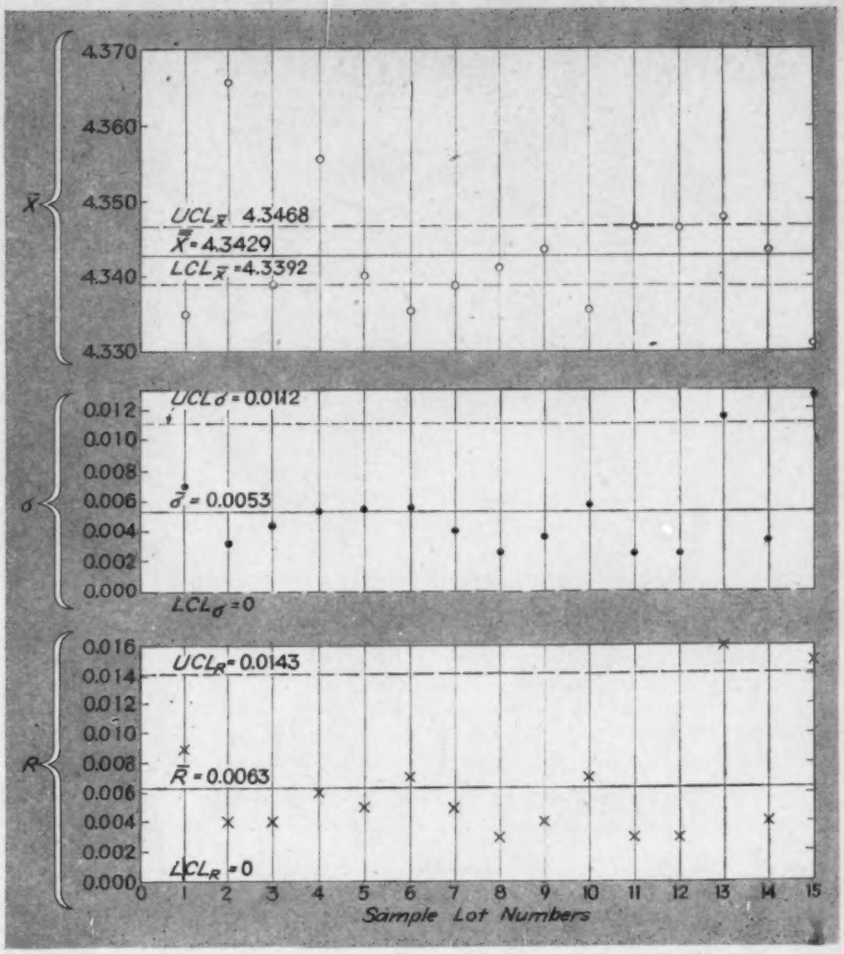


Fig. 12—From the work sheet in Fig. 11, the data are plotted in control charts. Lack of control is shown by many points lying outside of calculated control limits, both for averages and deviations

Grant, Eugene L.—"Statistical Quality Control," McGraw-Hill Book Co., 1946.

Shewhart, W. A.—"Economic Control of Quality of Manufactured Product," D. Van Nostrand Co., Inc., 1931.

Simon, L. E.—"An Engineers' Manual of Statistical Methods," John Wiley & Sons, Inc., 1941.

TIPS for Top Shop Men

164 Do signs and posters mean anything, or are they just dust-catching targets? "No Smoking" should mean it—or come down.

165 Have a "bull session" with your men once in a while, to talk over shop problems. In community discussions like this, the crossing of words and ideas may often settle problems that don't yield to executive analysis.

166 Pillory spoiled work, customer rejects, ruined tools —*but not the men.* Keep the display objective and you'll keep it effective; point the finger of scorn at individuals and you'll pillory them—and yourself.

167 Try awarding a "white elephant" or "bull of the month" to the gang or department that does the poorest job in some respect. This "kidding" will be taken seriously in a determined effort to lose the award promptly.

168 Don't be tricked into proving you're a "tough guy" by remarks that you or the company are "fascist," "dirty exploiters" or any of the other lingo of the organizer. The public won't remember such adjectives unless you give them importance by taking exception. Blow your top and you lose control of more than yourself.

169 Keep production lines on the level or flowing *downward.* The major advantage of American over English plants is that they're floored at truck or railroad-car height—so materials and products can be handled in or out without lifting. Let gravity help, not hinder.

170 Transfer men to help *them,* not you. If you try to pass on lemons, you'll get lemons in transfers, and one source of morale will go sour.

Foremen or Mice

BY A. F. SCOBLIC, CHIEF TOOL ENGINEER, THE HEIL CO.

FOREMEN falling into the "yes-men" category generally limit their own capabilities and dig themselves into a lifelong rut. Many foremen have contributed—without knowing it—to formation of various service departments. They have not kept abreast of fast-moving developments in shop operations and have automatically placed themselves in the back seat.

Such foremen are responsible for all things going on in their departments, yet many of them fail to see mistakes being made until someone brings their attention to them. This type has a long way to go towards becoming efficient. He must take more of an interest in his job. That means asking questions, as well as instructing and supervising.

The man on the machine is the best possible source of information as to the success or failure of an operation, and in either case it is the duty of the foreman to obtain all possible knowledge of even the minor details of an operation so he can make future decisions quickly and wisely. When ordering new methods or changes in an operation, he should inform the operator why the changes are being made. Most men like to know *why* they must do certain things, and the foreman who fails to convince the operator will have a grumbler in his crew.

Daily contacts and a helpful attitude will enable foremen to obtain knowledge of the personal characteristics of each man in their departments. This knowledge will serve as a foundation upon which to build an understanding of every individual; the one thing that proves so priceless to any leader of men. Once this understanding is secured, it must be followed by steadfast judgment and unbroken interest in the individual.

A foreman is usually expected to set an example to those under his supervision. A workman is sometimes judged by the condition of his tools; and it is just as reasonable to judge a foreman by the quality of his men. The foreman who complains about the poor quality of his men is no better than the operator who complains he cannot do the job because his machine is getting old—in each case it is just an excuse.

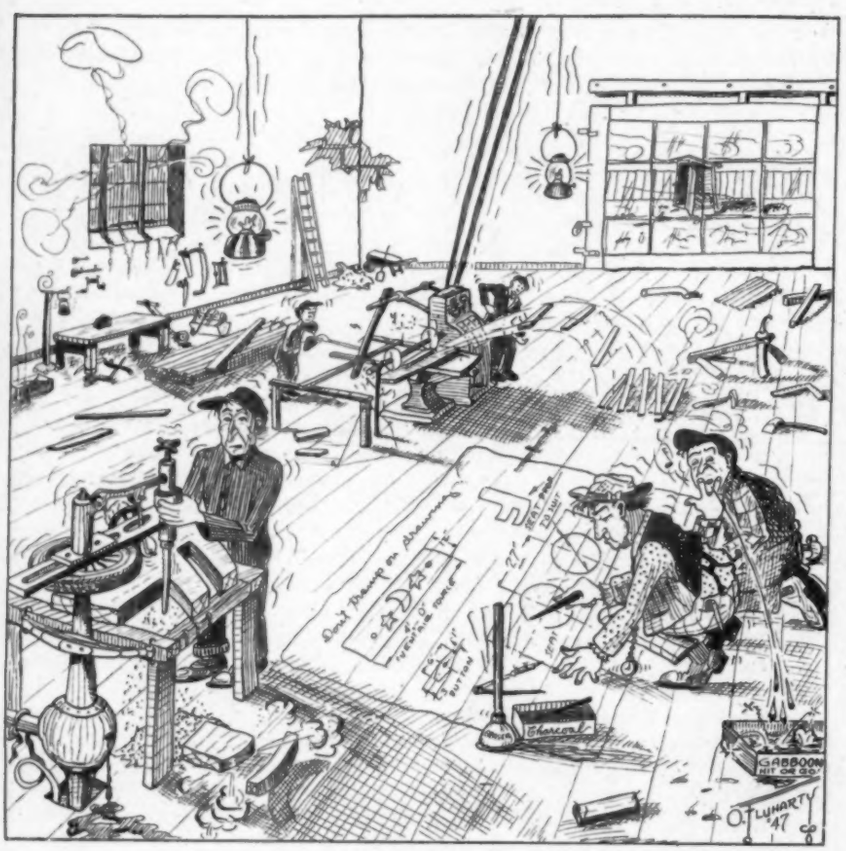
A good foreman or a good mechanic can and will solve the problem even though the odds may seem impossible to someone else. The foreman who is really on the job will constantly strive for betterment of all conditions; increasing production and quality; improving methods and promoting keener interest and cooperation between workers.

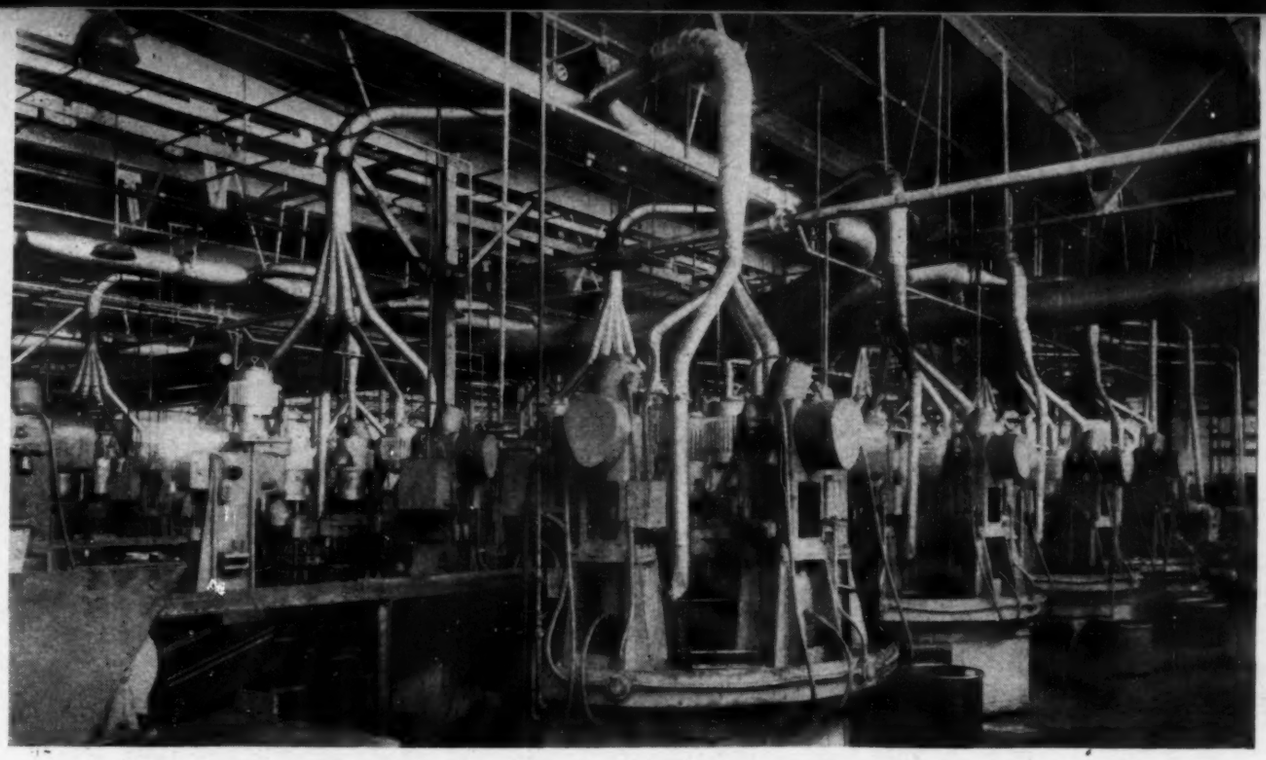
He will make a sincere effort to educate himself and then pass his knowledge on to others. If the willing foreman will avail himself of even a few of the evening courses, plant training classes, lectures and magazines, he will unquestionably reap a number of benefits that even he himself had not realized before.

A younger foreman must gain the respect and confidence of older men. He must prove first of all that he can take it. The quality, effort and ability of the young foreman will decide the length of time required to do a good job. He must be on the lookout constantly for opportunities to better his knowledge, experience and respect.

Foremen today must shoulder full responsibility in their departments. More power to those "mice" who can snap out of it and become one of the real foreMEN in industry.

OUR SHOP . . . 21—————*Precision Pattern Dept.*





Economy in air supply and piping in this dust-control setup at Delco Products Division of General Motors Corporation is effected by an engineered progression of riser and main pipes from the individual machines. The cast-iron dust is filtered in a unit located on top of the plant

Dust Control Need Not be Expensive

BY GEORGE E. TOLES

DUST, as a hazard to health, efficiency and production is often underestimated, and plant management may find it less expensive to control than to overlook. Practical dust control may be broken into three steps; dust suppression at the source, collection of the dust and disposal of the collected dust.

Dust suppression is forced direction of dust particles which would otherwise settle by gravity or be shifted by existing air currents. In plant production this suppression is the positive control of dust particles from their creation to their collection and disposal outside of plant atmosphere.

A minimum volume of air should be used for dust suppression, as this volume directly controls the size of pipes, collector, fan, motor—the original investment in dust control.

Many dust-creating machines are fully enclosed and escape of dust through small cracks can be prevented by attaching a small suction pipe to the machine to create a slight internal negative pressure.

Other machines may be hooded, leaving openings only for material to be loaded and unloaded, and chutes or conveyors which enter should be partially covered and a suction pipe connected to these covers or to the machine itself.

On the average, floating dust can be made to flow by an air current moving at 150 fpm. (less than 2 mph.). If a dust-creating machine housing has openings with a total area of 2 sq. ft. through which dust would escape with no force behind it then an air current entering the housing through this area at 150 fpm. would be an air volume of 300 cfm. In some cases agitation or motion (such as a belt conveyor) must be counteracted by an increase in the rate of flow of air used to draw dust into the housing.

Most industrial dust can be suspended within the entrance of a pipe by maintaining an entrance velocity of from 4000 to 5000 fpm.

The piping system consists of branch pipes and risers connected to the various dust sources—and the main pipe or header which leads to the dust collector. If the air enters the clustered risers at sufficient velocity the dust will be in suspension.

Size of the main piper or header, at any point, must be in proportion to the size and number of risers entering it. Velocity of the air may be lowered 10 to 20% in the risers when dust suspension occurs and the cross-section of the main pipe is correspondingly increased over the combined area of all risers. Increase in pipe size with corresponding lowering of friction reduces friction in the pipe and requires less power at the fan.

The second step, dust collection, is most important and the simplest method is by cloth filtration. Amount of filter cloth required is based on air volume to be filtered and it should be strong enough to withstand constant slight tension. A square foot of cloth should be able to handle up to 4 cfm. of dust-laden air. Dust concentration and its quality have a bearing on the amount of cloth required.

Collected dust may be dumped from hoppers or containers (integral with the collector) into carts or trucks or may be taken away continuously by conveyors, either in dry form or moistened.

ROUND TABLE

Whose Job Is Labor Relations?

"Why don't you spend a little time with your men on their problems once in a while, Ed? Most of those things they gripe about could be ironed out easily right in your department without sending in to Labor Relations, getting the committeeman, and spending more time, in the long run, than you would if you made up your own mind. . After all, Labor Relations is part of your job, and. . . ."

"Nope. No more of that complicated following rules and regulations for me. I tried handling a grievance myself with Jimmy Doyle. He had me so crossed up before I was through, I thought I was goin' to lose my own job. Too many things to watch out for. Contract terms, agreements, and what all. Better to refer a gripe to Labor Relations as soon as it starts. Those fellows are experts in settling grievances and might as well handle the case right from the beginning. Saves me time and trouble doing it that way, Al."

"I don't quite go along with your reasoning. I think it's better to hear the man out. He usually doesn't have too much to holler about, and the problem is settled on the spot."

"Tell me more, Al. You sound like that new guy up in the office who says that foremen are supposed to be part-time Labor Relations people along with their other duties. As though we haven't got enough to do already!"

"Well, I think Brannigan has something when he says that. If foremen don't carry their share of the labor-relations job, first thing you know, everybody and his brother will be sitting around the front office waiting to air their gripes. Unless we show that we can handle our men, we'll have a regular Dr. Anthony up front supporting a weeping wall for everybody who thinks something's wrong with working conditions, the boss, management, and anything else that comes to their mind."

"You sound as though all we had to do was to worry about settling grievances. How do you suppose we get production out—sitting down with someone every five minutes to talk over imaginary beefs? I still say Labor Relations hasn't anything else to do but that kind of stuff. Why not let them do it?"

"But don't you see, Ed, that pretty soon your men will come to look upon the 'expert' and not you as their counselor and leader? Your prestige and authority loses ground every time one of your men goes out of the department for advice or help. And you'll find that, with only a little attention, most men will come 'round to your way of thinking, and better relationships will result for both of you."

"Mister, you read that stuff in a book somewhere. Brannigan's had your ear, trying to talk you into doing part of his job for him. I'm not afraid of losing respect or prestige—I gained it in the first place by knowing my work and machines better than anyone else—I'll hold it the same way. A well-run department and knowin' your stuff is enough for any foreman."

***WHOSE JOB** is labor relations? If it's everybody's, isn't it likely to become nobody's? Can the specialist do any better than the supervisor? Your ideas and opinions will interest others. Discussions of earlier topics appear on later pages.*

Practical Ideas

Horizontal Crank Press Swages Tubes Automatically

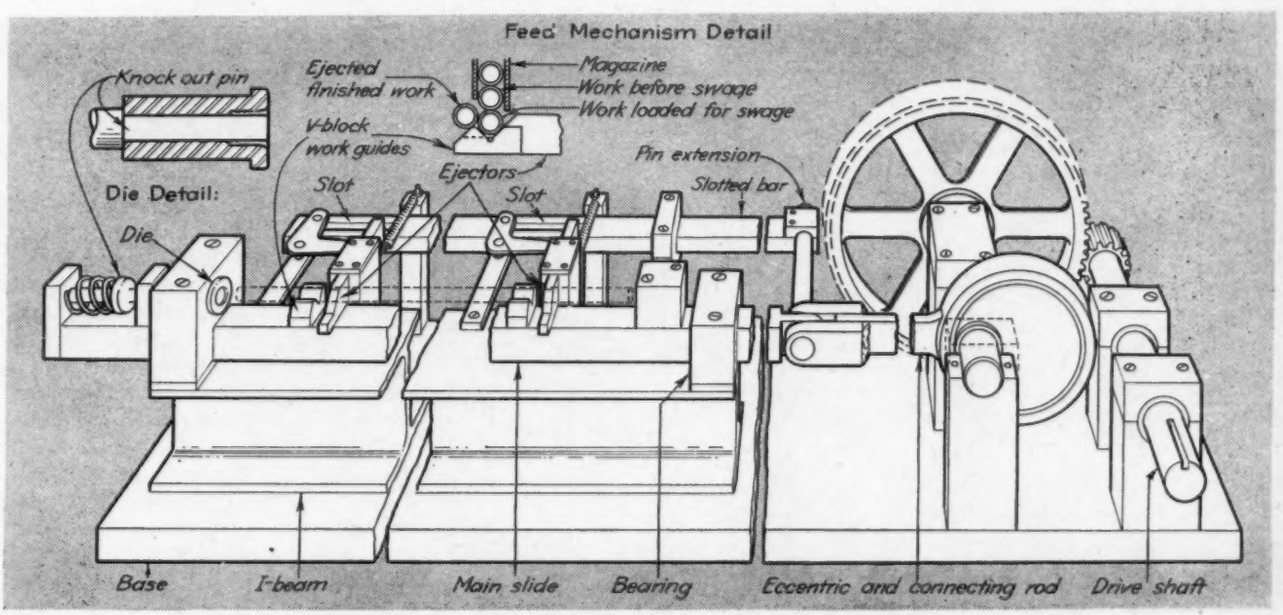
DONALD A. BAKER
Boonton, N. J.

Now, long, ½-in. dia. tubes are swaged automatically on this press. Tubes fall one by one by gravity from the magazine on to the reciprocating slide, get pushed into the die a fixed distance, and then are ejected making room for the next tube.

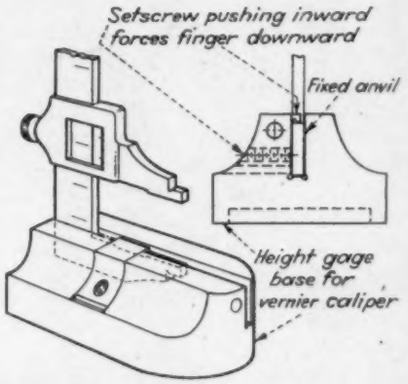
The slide is a square bar having two V-blocks on its top to cradle the tube. Its motion is controlled by an eccentric and a connecting rod which meets the slide in a clevis pin joint. Bearings at each end of the I-beam base keep the slide in place, and one of the bearings carries the die, properly aligned with the V-blocks. The outermost end of the slide has a spring-loaded knockout pin to drive tubes out of the die on the return stroke.

Another small slide or slotted bar is driven by the same connecting rod. Next to each of the V-block cradles is a transversely-sliding ejector bar which is actuated by a bellcrank. The bellcrank operating pin travels in one of the long slots and no motion occurs until almost full stroke is reached, when the pin hits the end of the slot and the crank turns, or both cranks turn, because their two pins hit simultaneously, and the two ejectors move across, lifting the tube from the cradle, and pushing it out the side. When the ejectors retract, another tube can fall from the magazine into the cradle ready for the next stroke.

The die should be bored to tube diameter for about ½ in. to assure a good straight start before swaging. Back in 1942, while serving my apprenticeship with General Electric Company, Schenectady, I had con-



Eccentric disk motion actuates two slides, one the main work-carrying slide, the other an ejector slide for unloading the finished work and permitting new work to enter



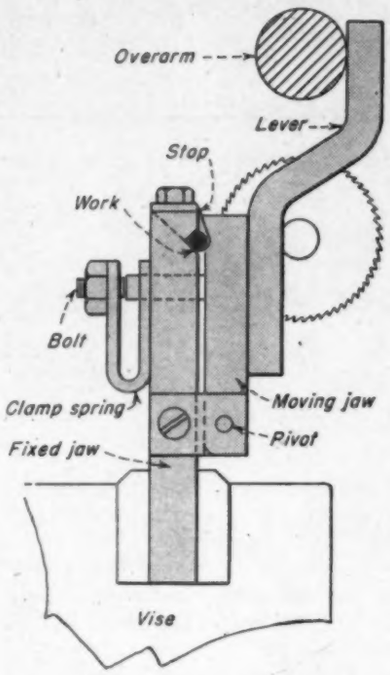
Setscrew pushes the caliper anvil against the side of the slot while reaction on the small bellcrank seats the anvil in the slot bottom

Toggle Clamp Base Makes Vernier Height Gage

L. L. GOULD
Watervliet, N. Y.

siderable use for a small height gage and decided to make a conversion base for my vernier calipers. Not satisfied with the single screw or yoke arrangement which is usual in fastening such bases to calipers, I hit upon a bellcrank clamp design which provided positive pressure in two directions, at right angles to each other. This clamp firmly anchored the calipers, making it possible to relocate the anvil exactly in the base at each assembly, leaving no protruding parts to hamper the handling of the gage.

Instead of pack-hardening the base and grinding it, I had it chrome-plated. This provided a harder finish than that obtainable by heat treatment, eliminated grinding to correct for distortion scale caused by heat treatment, and provided and attractive, corrosion-resistant finish to the whole job.



Spring jaw releases stock when the milling machine vise is backed clear of the cutter

Cut-Off Fixtures Improve Pin and Screw Production

BEN ARNOLD

We had to cut off a large quantity of ⅝-in. long pins from 1/6-in. diameter stainless-steel rod. The job was done on a horizontal hand milling machine at a rapid rate with the aid of an automatic clamping fixture of an extremely simple nature.

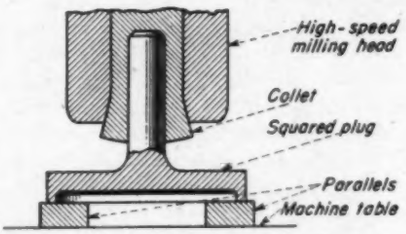
A piece of ½ x 1-in. stock with a 90° vee near one end along the 1-in. side forms the fixed jaw. To this is hinged the mating jaw which is held in the clamped position by a through bolt or stud and a stiff spring. But this jaw extends upward sufficiently to strike the milling machine overarm.

The lower end of the fixed jaw is clamped in the miller vise and the proper cutter mounted on the arbor. The lever extension on the moving jaw is now adjusted to bear against the overarm and pull the jaw when the table is backed away to clear the cutter. This releases the clamp allowing the finished piece to fall and new stock to be fed in against the stop.

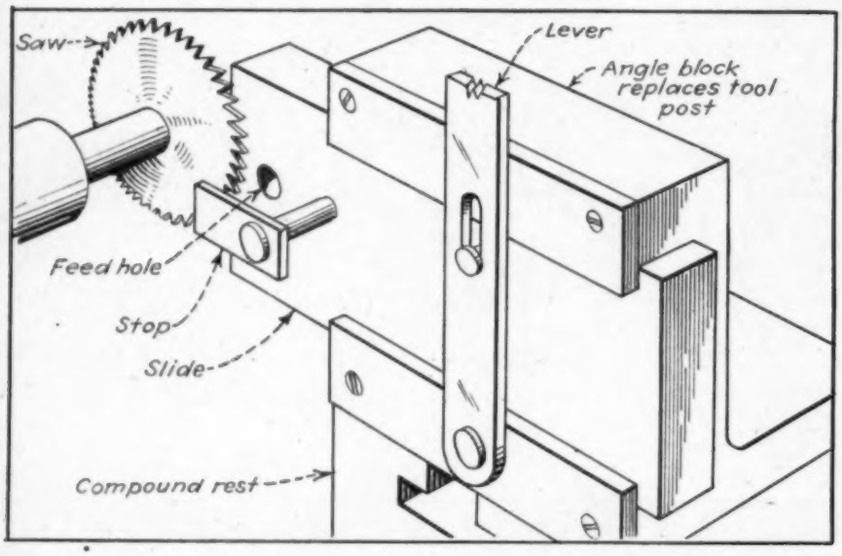
Then, advancing the table again, releases the lever and clamps the stock before cutting commences.

For similar cut-off jobs and screw slotting, another fixture was built for use on the lathe compound rest. Here, a saw is chucked in the lathe spindle and work is advanced against the jaw with the lever-actuated slide.

The sliding permits many kinds and angles of cutting. An end hole (blind) takes screws or pins to be slotted. Suitable stops regulate the slide stroke and screw position and, further, an automatic ejector can be ratchet-actuated on its return.



Squaring Tool—Turn a plug with a shank to suit one of the draw collets (½ in. is a good size) and face square with shank. Insert the plug in a draw collet, put two parallels underneath the plug, then lower or raise the table so the two parallels will pinch evenly. Then lock the head. This may not get it dead square but its accuracy is sufficient for most jobs. *Raoul J. Chevrette, Providence, R. I.*



Sliding block cut-off tool permits a wide variety of slotting, sawing or plain shearing operations

Oil Grooves—Oil on a heavy-duty bearing acts as a coolant as well as a lubricant. For this reason grooves in non-cooled bearings should be cut deeply and in a pattern to facilitate circulation. Such freely-circulating oil picks up the heat of friction from the bearing and dissipates it imperceptibly from crankcase covers, filters, reservoirs, or oil-pump lines.

In the water-cooled bearing lubrication is the only requirement, and grooves should not drain the bearing. Contrary to much common practice, hoever, the loop-shaped groove on the upbeat quarter should open against the direction of rotation. *George Holman, Marissa, Illinois.*

Flit-Gun Vacuum Principle Ejects Small Slugs

WALLACE C. MILLS
Rockford, Illinois

Perforating dies, as usually constructed, perforate downward and the slugs drop through the die. Sometimes it is desirable to perforate upward in order to gain some particular advantage in die construction. In the case of a multiple-station die for drawing and perforating the neck of a talcum-powder can top, it was best to run the cup-shaped stamping through the die with the open end up because the operator could feed the work more rapidly and because the die construction at all except the perforating stations was simplified. This meant that perforating had to be upward in order that the burr might be within the talcum can part and not on the outside surface.

As far as perforating is concerned, it makes little difference whether the perforating is downward or upward because the slugs are light in weight, gravity has little effect, and suction tends to draw the slugs back with the punches so that they drop into the die.

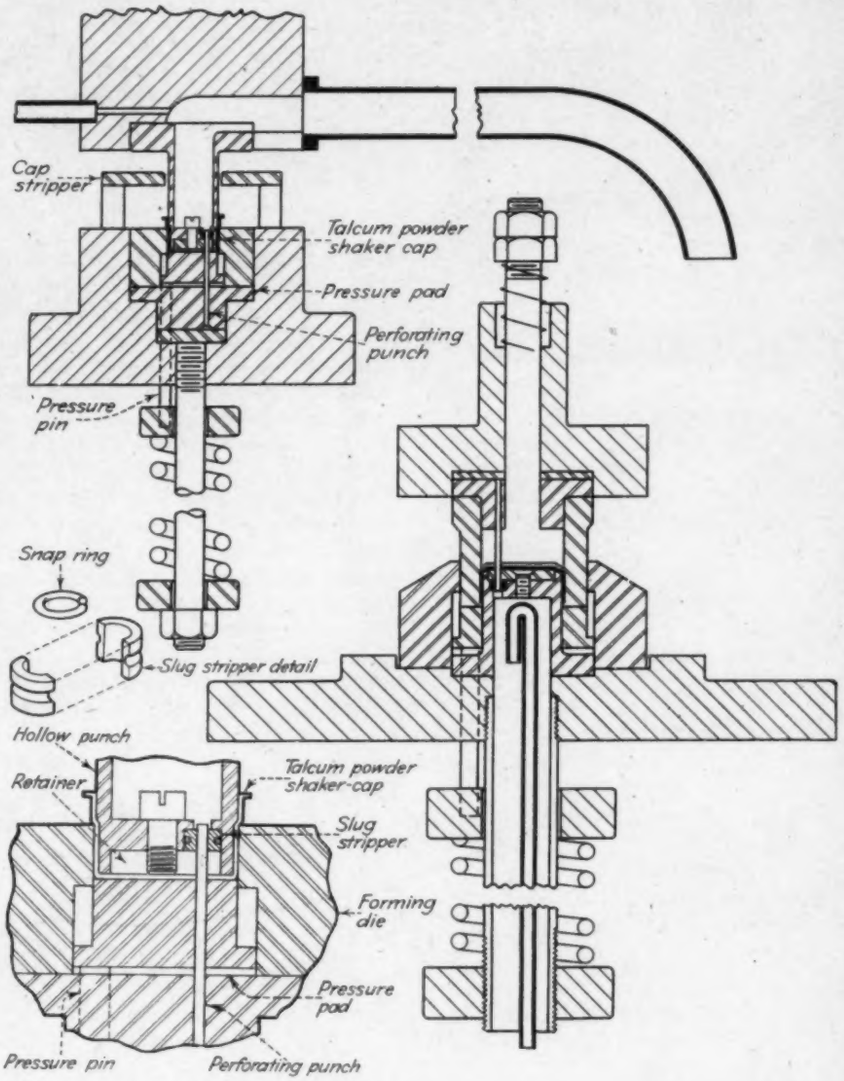
To remove the slugs after stripping, an air eductor is used. (This principle is found in atomizers for perfume, insect spray and paint, and in locomotive feed water injectors, ship bilge water eductors, and air ejectors to create very high vacuum in condensing steam power plants). The idea is that a compressed gas such as air or steam which is allowed to escape through a nozzle or restricted hole converts some of its pressure-energy into velocity-energy and therefore the pressure immediately surrounding the nozzle opening is less than everywhere else. Very quickly the gas expands and slows down losing all its energy but in the meantime it has carried with it whatever might have been in that low-pressure area.

A long discharge tube is needed so the air will expand slower and to preserve the vacuum. (In the case of atomizers, which have no discharge tube, the nozzle must be very close to the material to be picked up, and the "carry" will depend entirely on the strength of the blast).

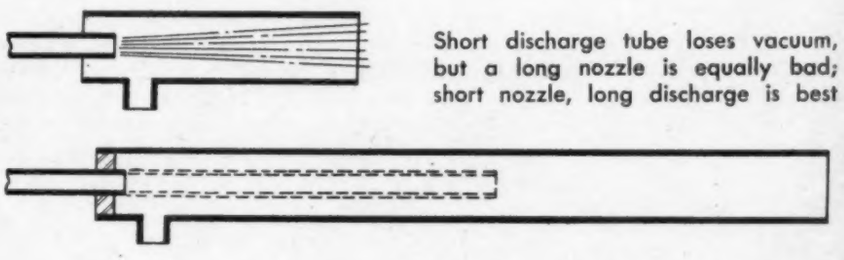
Here, if a short tube were used, the vacuum *at the nozzle* would remain the same, but it would disappear a very short distance away.

It is necessary, also, to have the nozzle short—not out in the discharge tube—for the same reasons.

As the operation is a combination of forming and perforating, the cap is held in place with a spring-controlled pressure pad while the perforating punches are rigidly mounted within the forming die. Compact slug strippers are required so they were made in halves and held in position over the punches with snap rings.



Press sequence in making talcum powder caps made upward perforating preferable so an air nozzle and ejector tube was added to get rid of the small slugs. Downward perforating can use jet principle too



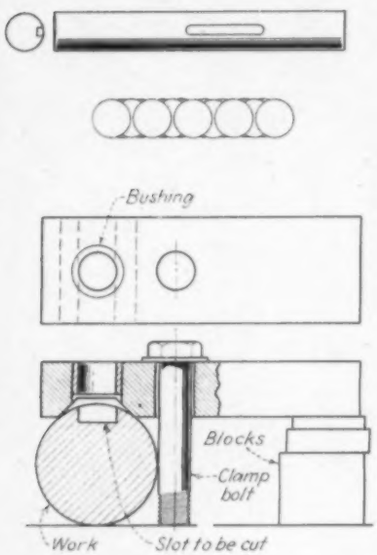
Short discharge tube loses vacuum, but a long nozzle is equally bad; short nozzle, long discharge is best

Hints on Small Tools

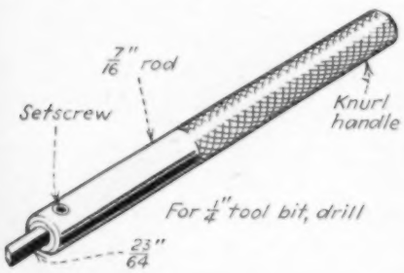
EARL R. GODDARD

Drilling Keyways—Many slots are drilled, chipped and filed when better equipment isn't available. Here is a jig which simplifies the drilling and by permitting more holes, reduces chipping and filing to a minimum.

Clamp the shaft so the line of

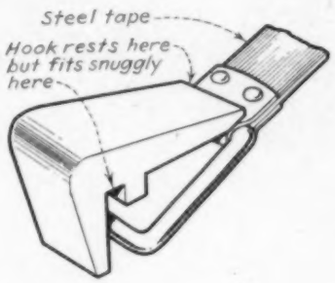


holes is vertical and the slot length is well clear of the clamps. Bring the jig bar over the first of the five complete holes after they have been prick-punched and clamp it in place. This bar should be heavy enough to preclude springing. A heel block is used to keep the jig plate horizontal. Drill the first five holes with a standard drill, drill the rest with a drill ground to 160° included angle point at higher speed and a fine feed.



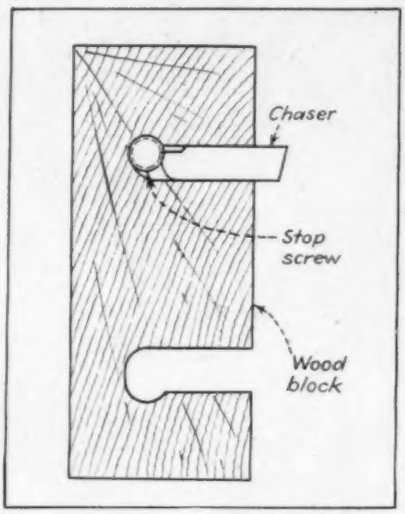
Grinding Toolbits—Here's a holder that will hold long or short toolbits when rough grinding. The bit can be held much steadier and the holder is especially useful for short pieces. The setscrew should be placed close to the end.

Center Drill Holder—In center drilling short parts, the tailstock spindle must be run out quite a distance even when both carriage and tailstock are up as far as they will go. After center drilling, the spindle must be retracted again both to be sure of adequate feed for the drill to follow and to assure rigidity. This time-consuming out-and-in step, and the center drill chucking step have been eliminated by providing the center drill with a semi-permanent extra long taper shank holder. This gives the center drill plenty of support and cuts out the long feeding of the tailstock spindle. The center drill must be a snug fit in the shank, and of course, the shank must be made with great care to preserve concentricity.



Tape Hook—Easily put on a tape buckle, this hook will come in very handy at times. The slot is first cut to buckle diameter then the back side is carefully filed to fit inside. The back end of the attachment is rounded out to lie on the tape loop. The finished slot should fit snugly. The attachment can be taken off just as quickly as it's put on.

Testing Babbitt—When pouring the heavy-duty bearing with babbitt of unknown properties, of any lead-based babbitt, of scrap babbitt, or of any babbitt suspected of having been overheated, pour a test piece of the residue babbitt into a short piece of small angle iron. When cool, strike this piece progressively harder blows on a bench edge inspecting it by sight, straight edge or lying on bench plate. If test piece bends, babbitt is too soft to support heavy engine or machine shafts, or withstand continuous reversals of stress as in crank and crosshead bearings. Good babbitt test piece will break without bending. *George Holman, Marissa, Illinois.*



Cleaning Turret Screws — Dried coolant makes turret lathe stop screws sticky, gummy, and hard to adjust any distance when changing setups. A block of wood was slotted to fit a discarded diehead chaser of correct pitch and bored to clearance diameter for the screws. The clogged screws now are cleaned by turning them in the block with finger pressure against the chaser to cut away the dried material. *W. F. Woolery, Minneapolis.*

Lapping Valves—A small piece of plate glass makes a good lapping plate for refacing D-slide valves on duplex pumps. A second plate covered with prussian blue is kept ready for checking the progress. High spots can be scraped or filed off initially. *George Holman, Marissa, Illinois.*

Press Feeder—In an emergency, we once used a home washing machine clothes wringer to feed some 6-in. stock to the press. The rubber got soft because of the oil so the rolls were replaced with fiber ones of the same diameter. The rest of the mechanism was left as is. *Paul Shoemaker, Williamsport, Pa.*

Radius Turning Tool Requires Minimum Machining

HENRY RASMUSSEN
Niagara Falls, N. Y.

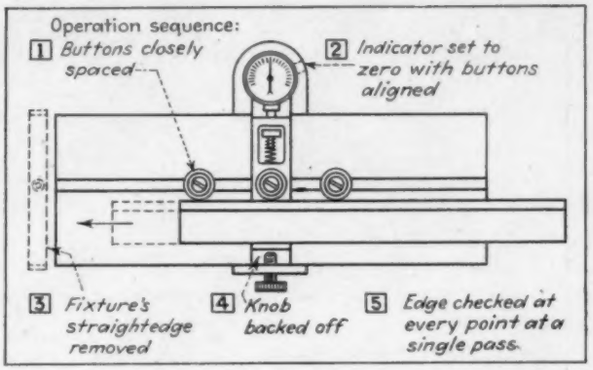
Here is a very simple radius turning tool that can be built in one hour or less, but whose range is practically unlimited. Construction is simple and adjustments easy and quick to make.

The lower or fixed plate is bolted to the lathe cross slide or compound rest. In it are two holes providing two positions to mount the pivot pin. The pivot plate rests atop the fixed plate and swings about the pivot pin under control of the long handle in one end. The pivot plate also has an alternate pivot hole providing a total of four possible pivot positions, and in addition, it has three possible locations for the fixed toolpost, which fits into one of the counterbored holes in the pivot plate.

The toolpost has a square hole near its top which centers the toolbit exactly with the spindle, and the toolpost is secured in its location with a countersunk flathead screw from the bottom of the pivot plate.

Radii are determined by the distance the toolbit point is away from the pivot axis. In the position shown, the radius is zero; if the toolbit were tapped forward slightly, the cut would be concave; if retracted, the cut would become convex. To measure the exact radius, replace the pivot pin temporarily with a long pin of the same diameter and measure from the pin to the toolbit with feeler stock, telescoping gages, or inside calipers, and then add half the pin diameter. When the toolbit has to be extended so much that it begins to chatter, you should be able to move the toolpost to the next hole and thus bring the bit right in comfortably close to the post.

The fixture is intended primarily for finishing work and very little provsion has been made to assure absolute rigidity. It was felt that the simple, quick adjustability and ease of construction outweighed any other factors. But, with customary work rotation downward against the toolbit, there is no tendency to lift the plate, and with light cuts, the tool produces an excellent finish.


Operation sequence:
1 Buttons closely spaced
2 Indicator set to zero with buttons aligned
3 Fixture's straightedge removed
4 Knob backed off
5 Edge checked at every point at a single pass

After establishing accurate alignment of the closely spaced buttons, any length straightedge can be passed along the buttons from one end to the other, giving continuous indication of error

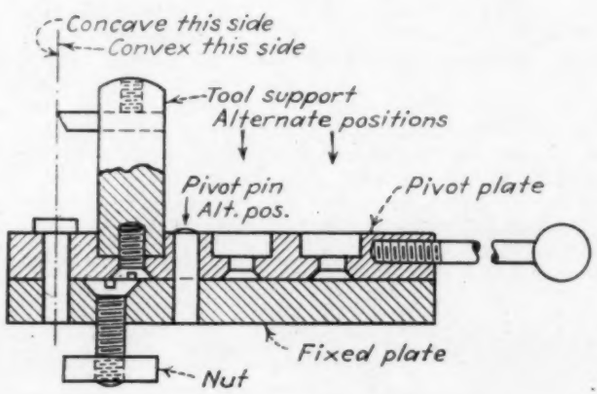
Straightedge Tester Gives Complete Graphic Record

S. FRAMURZ
Bombay, India

After one simple setting of the tester* described in a recent issue of *American Machinist,* straightedges of any length can be tested over their entire length and the dial indicator will graphically show any variation from a true straight line continuously as the edge is passed along the three buttons from one end to the other.

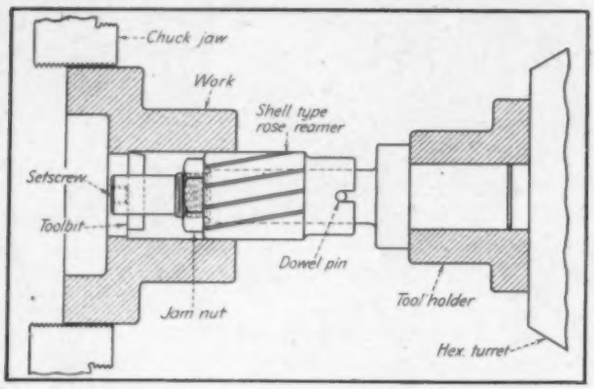
To adjust the fixture for this test, the T-head is removed and the two semi-fixed buttons are brought in close to the cross slide and locked. Now, any edge is brought against the three buttons and the knob is locked, bringing the third button snugly against the blade. This reading noted, the blade is flipped over and the other reading is noted. The knob is next adjusted until the indicator reads one-half the difference of the two initial readings, and then the indicator's zero adjustment is used to bring the pointer to zero. Now remove the fixture's straightedge by backing off the knob and the setting is complete. Any edge, regardless of length, now can be passed along the three buttons and the actual error will show on the dial. The only limitation is the location of the tester itself as to end clearance. Comment might be made that as a straightedge was incorporated in the tester itself, an edge, to be tested, might as well be compared directly with the tester's straightedge. The answer is that, for one thing, the tester's straightedge is only a short length, while the tester can check any length of edge and provide quantitative errors as well. Actually, the tester's straightedge can be dispensed with entirely for the initial setting is an average of two readings which will establish a straight line regardless of the edge used. The purpose of the straightedge in this tester is not to test other straightedges but to establish and compare right angles and squares.

The only accuracy incorporated in the tester itself is in the dial indicator and in the toolmaker's buttons so it can be used to develop or originate a true straightedge and an accurate 90° angle without any prototype or other instruments.



Ball and concave radii over a wide range can be produced quickly by selecting suitable pivot and toolpost locations and adjusting the toolbit to the exact radius

* *Editor's Note: This tester is the same fixture that Mr. Framurz described in an earlier issue, but this material was not available in time for publishing then. P. S. That item was selected by the jury of readers as the best one in that issue.*



Boring bars with a driving pin and threaded neck permit boring and finishing in a single operation. Just slip on the right rose reamer and draw up the nut against the end of the reamer thus locking it in place. On the opposite end of the bar a square hole is shaped to fit a standard square toolbit. A hole is tapped in the end for a setscrew which clamps the toolbit in place.

Once the reamer becomes dull or worn below size it is a simple matter to back off the nut and put a new one in its place.

Combination Reamer Saves Two Turret Steps

ROGER ISETTS
Kenosha, Wisconsin

Boring and reaming large holes usually involves three separate operations: (1) rough bore, (2) finish bore, and (3) ream. This procedure necessitates three individual stations in the turret. Naturally, then, eliminating even one of these operations would result in a considerable saving in machining, as well as setup time. In this particular case it was decided to do away with the semi-finish operation and combine it with the final ream. This meant a special tool had to be designed to do the job. With the bar shown in the accompanying sketch we found that these two operations could be effectively combined. For the bar itself, a piece of round cold-rolled stock is used. For the reamer, we used an ordinary shell-type rose reamer. The making of the bar is not difficult. It can be turned out in the toolroom in a few hours. One end of it is turned down to fit the tool holder in the turret. A dowel pin is pressed in at a convenient distance from the end and fits in the slot in the end of the reamer to act as a driver. A thread is cut on the bar to receive a standard jam nut which is drawn up

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Welding Press Stock Scraps—Appreciable savings can result when a bandsaw welder is used to join together an accumulation of short pieces of strip stock which cannot be fed through the die by itself. Or, the welding can be performed just as one long strip is about to be used up and the next is about to enter. In this way, punching can be kept continuous and there will be only one reject at most. *Jack Nestor, Brooklyn, N. Y.*

Screwdrivers won't slip as readily if a bit of emery dust and a few drops of oil are applied to the screw slot. Valve-grinding paste will serve the same purpose. *D. L. Leslie, Birmingham, Mich.*

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Twenty-fourth Selection—A. F. Scoblic's Key Seating Fixture

TAX REVISION...

Can Make or Break American Business

IS THE American way of life—progress by private initiative—going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U.S.A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting $6 billions out of President Truman's $37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below $25 billion for any year that is in sight.

Drastic Budget Cuts Required

Indeed, to get the tax load down to $25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize *every* item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms—especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eighty-six percent of the experts agree that an income-averaging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets—and particularly for management men—has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise—for example, the confiscatory rates which drive the people in the high brackets away from risk-taking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards—as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such tax exemption must be eliminated.) The list of obstacles could be amplified.

Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off $800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as $4 billion.

Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly—and as sensibly—as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.

Through such a design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the necessary estimate.

Instead, federal tax revision continues to be a hit-and-run business—and a short-run political business. Take, for example, the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.

EXPERT OPINION ABOUT TAX REVISION

TAX EXPERTS THINK WE SHOULD:	% Of Tax Experts Favoring the Proposed Changes
1 ***Eliminate double taxation of corporation dividends*** which are now taxed as corporate profit and then again as individual income.	92%
2 ***Reduce corporation income tax rate (now 38%)*** as rapidly as budget needs permit until it equals the initial rate for individual incomes (now 20%).	73%
3 ***Provide for averaging business' taxable incomes*** over a period of about 6 years to allow for losses in bad years.	97%
4 ***Provide for averaging individuals' taxable incomes*** over a period of a few years so as to treat fairly those whose incomes fluctuate.	86%
5 ***Reduce upper bracket individual income tax rates*** to a maximum of 50% in the $100,000 bracket and 75% in the million and over bracket.	76%
6 ***Treat capital gains, now taxed at a lower rate,*** like other income but provide full allowances for losses.	64%
7 ***Remove the privilege of tax exemption*** from all future issues of state and local government bonds.	92%

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

Manufacturing Research Concentrated by Harvester

Surplus war plant being converted to house extensive organization directed to improve company manufacturing methods. Three broad fields will be dealt with in eight major laboratories

CHICAGO, ILL.—The "Manufacturing Research Center" for which International Harvester Co. last year bought a 230,000-sq. ft. war surplus plant here has progressed to the stage where it should be going full speed by some time this fall. Several departments are already functioning to the extent permitted by equipment thus far received.

Product improvement, new product development, and research into the basic and applied sciences which lie behind product and process are the conventional assignments of industrial-company laboratories. Harvester's executives laid out a novel and entirely different type.

Objectives

They instructed the head of the unit to direct his staff's efforts entirely toward improving the company's production methods, and interpreted these instructions liberally to include some broader aspects of manufacturing management. The task was defined thus:

"1. To study and conduct research concerning technical manufacturing activities of all kinds. To assure Harvester that it is in close touch with technical progress and all developments which flow from the efforts of scientists, engineers, and practical factory men in this country and throughout the world.

"2. To formulate standards of manufacturing practices to be followed by the various divisional manufacturing departments.

"3. To conduct manufacturing operations research directed toward continual study and improvement of the organization and management of Harvester manufacturing activities.

"4. To conduct training activities concerned with manufacturing."

Ideas and problems are expected to arise from three principal sources: (1) The company's organization as a whole. These may come from manufacturing plants, from other research groups inside the company, even from sales department people forwarding customer complaints, suggestions, and the like; (2) The manufacturing research department itself will propose projects when it observes opportunities for making improvements; (3) Outside sources, including other industries, schools and universities, and technical literature will pose occasional questions that require answer for the best interests of company manufacturing.

Harvester executives emphasize that manufacturing research of a highly practical nature has been carried on with excellent results in the company's plants as far back as anyone can remember. The Chicago laboratory is designed to centralize much of this research and give added impetus to the activity, but not to end grassroots efforts to find better methods. It is not intended as a way to cut total outlay for manufacturing research, instead is expected to increase this expense substantially. But it is expected to produce more value in research findings per dollar.

The new research laboratory comes as a natural consequence of the fact that theree years ago Harvester redrew its organization chart. Until then, all manufacturing was under a company-wide manufacturing department, all sales were under a sales department, and so on.

This functional design was supplanted in 1944 with a divisional organization more like that of General Motors and other companies whose size and product complexity are comparable with Harvester. Now individual operating divisions are set up to design, build, and sell one major line apiece—farm implements, motor trucks, farm tractors, industrial power, and so on.

Staff units are maintained with company-wide scope to act as service departments assisting the operating divisions. One such staff department covers manufacturing. The Manufacturing Research Center comes in its jurisdiction.

Advantages

A major reason for setting up the new laboratory is that research at the plant level is properly and primarily interested in that plant's own problems—and attitude not in keeping with the company's broad diversification. In a production plant, research is necessarily secondary; under the stress of manufacturing schedules it may be interrupted and the partial effort irrevocably lost. If completed successfully, its results may never spread beyond the plant.

Company-wide research guarantees that a promising study under its auspices will be driven through to completion and that valuable findings will be distributed to all plants. Conversely, when a proposed project is either rejected for cause or carried to an unsuccessful conclusion, these facts will be fully recorded and kept available for future researchers to use in making their own decisions on proposed studies or in providing new points of departure for later work. Carried to its logical end, broadcasting of methods research results throughout all Harvester manufacturing establishments should eventually mean that important processing operations in all of the company's plants can be standardized at optimum methods determined by the researchers.

Duplication of research is much more probable when conducted at the plant level than when carried on in a central laboratory. Also, bringing the bulk of the company's research into one building brings together the leading research men in the company, where continual contact with other experts in related fields stimulates all of them.

Freedom of Action

As any methods-study engineer knows at first hand, research activities carried on in a production department with production-department equipment are seriously handicapped. If production needs a piece of equipment that he is working with, his experiments are necessarily suspended until the machine is again free. When he has a machine solely used for research, no production schedule can get in his way.

Fowler McCormick, chairman of the board, is the actual father as well as godfather of the Manufacturing Research Center. Before he became president of the company in 1941, he had charge of all its manufacturing. The centralized research idea was born then, but it could not be materialized until the end of the war made it possible to concentrate management attention upon the program, and to get the requisite building, personnel, and physical equipment.

Manager of Manufacturing Research, hence bossman of the new center, is Merle C. Evans. Those plants in which he served as assistant manager or manager had a habit of bobbing up with methods improvements based upon thorough research. When he became manager of manufacturing of the farm-implement plants, the same tendency

appeared through his broadened bailiwick. Add to this a mild manner in the best tradition of research scholarship and an ability to get along with scientists, technicians, and engineers; these made Evans a natural for the new job.

Evans' studio approach to production problems meshes smoothily with McCormick's studious approach to executive management. The chairman is forever emphasizing the need for better management techniques throughout the company's worldwide organization.

Since the announcement a year ago of the new research center, its assignment has grown to include one major concept which has all the earmarks of having been incubated in the chairman's office. This extension is to develop better techniques not only of functional manufacturing but also of manufacturing management.

McCormick previously set the staff sales department to conducting a similar type of research into functional sales-management techniques. Observers inside and outside the company are guessing that this may presage an eventual research undertaking which would take over these two management researches, add to them similar functional management projects in engineering, finance, and other major executive functions.

Specialized Research

Top executives of the company emphasize that the manufacturing research department is a center for specialized research on individual projects rather than a laboratory to be turned loose upon a vague program of general research. It will have nothing to do with product design and development, or with engineering research. It will, however, upon invitation interest itself in production engineering on new products while these are being developed by design engineering groups in the company. The purpose is thus to give manufacturing men abundant and thorough information on the production of the new item promptly after it is ready for commercial output.

The laboratory is being equipped to handle a wide variety of research projects, but by no means all that are likely to fall in its lap. When the type, size, and cost of duplicating plant facilities would be out of proportion to the expectable yield in research findings, the center will either seek arrangements with schools and universities to utilize their equipment or get temporary aid from company plants.

The metallurgical laboratory will be equipped with a million-volt X-ray machine, and an electron microscope. There will be a small foundry for gray iron and nonferrous

Grandson of Founder Cyrus Hall McCormick, 48-year-old Fowler McCormick, board chairman of International Harvester Co., has emphasized improvements in management techniques—the latest being the Manufacfacturing Research Center. This brainchild was conceived during his 3-yr. stint in charge of manufacturing

—Portrait courtesy Business Week

metals, and a machine shop of considerable scope. But the center will have no forge shop, instead will use forging equipment in the company's production plants.

When operating at the rate for which it is designed, the center is expected to employ between 400 and 500 people. Many will come from company offices and plants in Chicago.

Economy the Object

The department will seek the most economical method of manufacture for products already in the company's line. Also, it will attempt to do the same for new or improved products as they come from engineering development to the production departments.

In seeking lower costs on existing products, the laboratory will conduct projects aimed at cost reduction for specific items. Also, it will compare similar operations in plants which have dissimliar costs. When a better method is uncovered, it will be circulated throughout the company's manufacturing operations, for whatever benefit it may offer. Expectation is that these will lead to uniformity of practice and method within the company's plants. It is planned that on occasion the manufacturing research department will get specific assignments form the top executive group to study and recommend improvements in the organization and management of one or more of the company's plants.

Besides its assorted routine activities, the administrative section includes one section of quite different type; this is education and training. Beyond this, the Manufacturing Research Center is set up with seven subdivisions with from one to seven activities apiece. The list is:

Methods planning and engineering section: Methods planning and engineering, Machining laboratory, Machine-tool availability control section.

Research laboratories: Metallurgical; Foundry; Welding; Paints, oils, and varnishes; Materials handling and product protection; Forging; Industrial feeding.

Manufactuiring standards.

Plant engineering.

Inspection methods.

Wage administration.

Adjuncts: Investigation of occupational diseases, Plant protection.

Duties

The education and training section is set up to train selected personnel of divisional manufacturing plants on special problems and in special subjects. In general terms the personnel selected for schooling here will be men particularly capable of absorbing instruction and subsequently transmitting it to others back home in their own plants. Another less-obvious result is counted on by top-level executives. They believe there is a major advantage in bringing into the research center the most promising youngsters research-wise in the entire manufacturing organization and giving them close-up contact with the company's foremost research men. Thus there will be a transmission of progressive and open-minded management ideas from research centers to manufacturing plant in a manner that will shortcut the relatively slower traditional method. When new ideas have to move through channels, their spread and adoption can be retarded by the less-receptive minds of some of the older men who usually head up plants.

Operating Method

For a quick view of how the education and training section should operate, let's have a look at training in high-speed milling. While the development of high-speed milling is being completed, the manufacturing research department will investigate it. If the laboratory reports favor its use and if it is adopted, factory men will have to be trained. The most advantageous training place in the company would then be that which is most familiar with the process—the manufacturing research center. If operators must then be trained in high-speed milling, they will be trained at the plants by the men originally trained by manufacturing research.

The same development can be looked for as new welding processes

develop, or better techniques in many shop operations. If new welding equipment comes along equipped with unfamiliar electronic timers, presumably the research center will be best situated to train instructors from the various plants—not in the theories of electronics, but rather in maintenance of electronic timers.

Formerly each plant conducted its own program of training and education in such subjects. The training was not of consistent quality from plant to plant, and the plant which learned a best procedure did not always pass it along to other plants.

Methods Planning

The methods planning and engineering section exists to develop new methods, processes, and procedures for Harvester plants. To this end it will analyze products, operations, and costs in relation to manufacturing operations and plant layout. It will be prepared to accept any existing product for a manufacturing cost reduction study. On new products, it is planned to establish the most advantageous method of production in advance of the time that the engineers turn over the product for manufacture. At this time this section will presumably be able to advise the company management with an estimate of facilities required for manufacture, proposed routings through production operations and an estimate of the manufacturing cost of the product.

This section includes the machining laboratory. It will have sufficient machine tools to research any machining methods typical of company plants. It will also work with special-purpose machine tools which will be brought into the laboratory for use when problems cannot be worked out with its existing complement of general-purpose machine tools. This laboratory will also try out new types of machine tools offered for sale by suppliers, before quantity purchases are authorized. The section will also have space for setting up pilot-line manufacturing to prove tooling, check its recommendations of facilities, and make time and motion studies.

The machine-tool availability control subsection of the unit will establish and maintain a company-wide system of numbering and identifying machine tools. It will analyze and summarize machine tool load reports from all plants, to determine the need for and the procedure for transferring machine tools or machining jobs between plants when production loads at the plants are out of balance with their machining capacity. The available records will be used to determine whether idle tools or idle machine time can be used in lieu of purchasing new equipment. The unit will also determine whether obsolete or idle tools should be stored, modernized, reconditioned, or scrapped.

Space limitations forbid detailing the scope of each laboratory in the Manufacturing Research Center. The metallurgical lab will include microscopy, sample preparation, photography, electron microscopy, and physical testing. The chemical lab will handle oil, grease, rubber, fabric, plastics, plating and corrosion testing. The metals treatment lab will cover heat-treatment, induction hardening, shot-peening, micro-abrading, metallizing, and powder metallurgy. The physics lab will take care of X-ray radiography, magnetic testing and sonoscopy, spectography and X-ray diffraction, photo-elasticity and stress analysis. And so on with the foundry, welding, paints-oils-varnishes, materials handling-products protection, and forging laboratories. Industrial feeding will be studied in a modern cafeteria and kitchen.

Other Sections

The scope of most of the other sections listed previously is apparent from the names. Manufacturing standards section will seek to get all useful information produced by the center's researches, will codify and classify it to concise, usable form, and pass these along to company plants. Plant engineering section will maintain contact with plant engineers at each works, keep in touch with plant engineering activities in other industries, make comparative tests of equipment and supplies, and channel this knowledge to all plants. Inspection methods section will make studies of all inspection practices and where practicable will set up standards for quality control. Wage administration will undertake a continuing study of company wage plans and those of other employers.

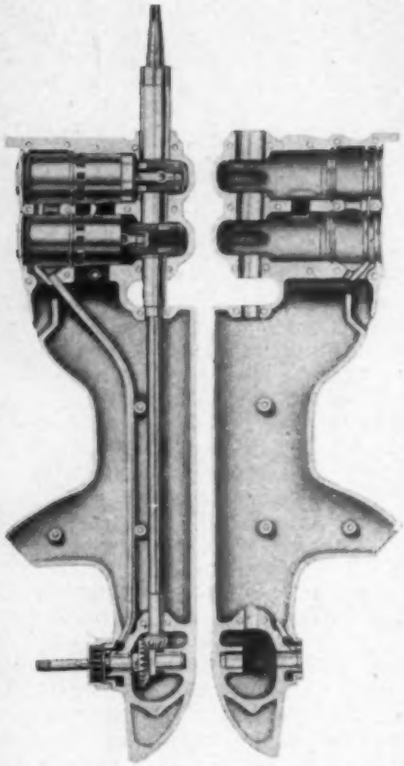
Specialties

Investigation of occupational diseases will be housed in the center, will be supervised by the company's medical staff. The objective will go beyond making the job safe in all of its visible aspects, will reach out to discover the invisible hazards, seek to anticipate and guard against toxic influences in new processes before the job is placed in a plant. More usual problems, such as skin irritants, dust exposure, psychological and physical effects of the work, of heat, volatile vapors, and solvents will be covered, too.

The plant protection unit will seek to coordinate an activity which has had little coordination. It will make periodic inspections of plant apparatus, property, and buildings for fire prevention and safeguarding against fire, theft and damage.

The Shop Can't Make All the Savings

BY CHESTER S. RICKER, DETROIT EDITOR



Unconventional "Flambeau" 2-cycle outboard motor, made from two aluminum-alloy permanent-mold castings, with ports cast in, weighs 15% less than conventional engines. Cylinders are steel, 1 15/16 x 1 9/16 in. (9.24-cu. in. displacement) with integral head, valve ports and midpoint locating flange. Pistons and rods are aluminum alloy, main bushings are bronze-bushed

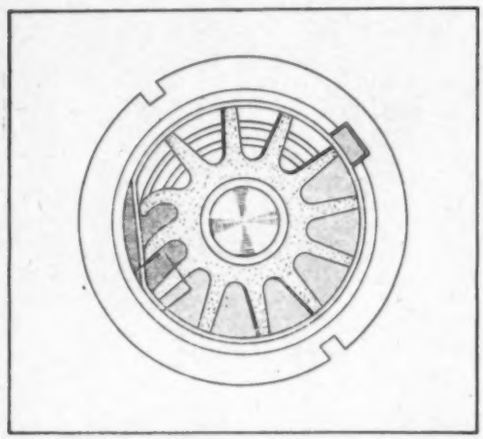
DETROIT—John D. Gordon, general manager, Progressive Welder Co., recently told a group of engineers: "Every day, I see products that were designed without collaboration with the shop and marvel that production men have found a way to build them in quantity and at reasonable cost."

Another engineer who spent several years in Russia before World War II commented thus on the chief engineer of one division of the Big Three auto makers: "No Russian, and few other European, engineers would believe it if I told them that this successful engineer gets out in the experimental shop almost every day to check 'squawks.' The last time I was in the shop, I found him lying on a creeper under the car!" He knows the design from every standpoint—strength, performance, ease of assembly—and has gone over every detail with the men who are to build it. He is the kind of designer who does not need a private office with his name and title on the door to give him prestige and authority. He is not afraid to get his hands dirty and knows the product so well that he helps both management and the shop get production at the lowest possible cost.

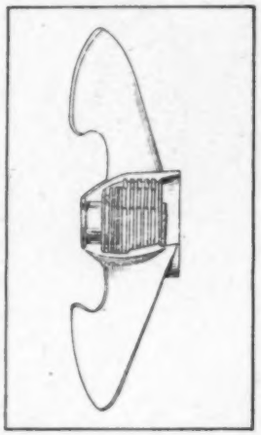
It is this cooperative point of view between top management, engineering and production men that is going to pay dividends in the next few years. In fact, it may mean survival of a business. Ernest R. Breech, executive vice-president, Ford Motor Co., was heard to remark that you cannot cut costs on present car designs enough to meet rises (since 1940) in business, transportation, material and labor costs. The job has to be redesigned right from the start to get costs down and sales volume up without sacrificing performance.

Cooperation between designers and production men—plus smart planning—is the key to economy in production and assembly costs

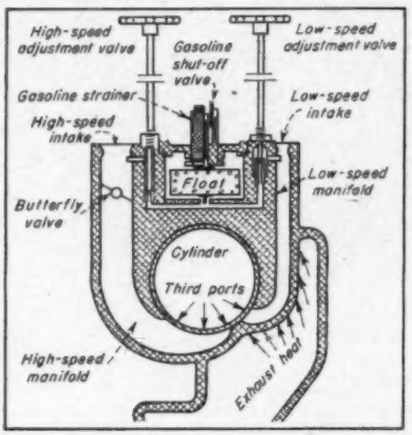
During the past two years, industry has made much "face-lifted" pre-war merchandise to fill the sales void as quickly as possible. But new merchandise must not only be built and sold for less than 1939 or 1940 rejuvenated models but also must have attractive appearance and sales features. Only by top cooperation between designers and production men can costs be kept down. Biggest savings are in the initial design, which must make the product easy to produce, conserve material and save in assembly cost. Evolution won't cut costs appreciably. The design must be revolutionary in character. One of the best recent examples of this is the "Flambeau" outboard motor, made by Metal Products Co., Milwaukee. Pictured is the engine, unconventional in design and bristling with production shortcuts.



Neoprene impeller in the built-in water pump is cheap to replace, resists wear from silt and sand in the water. It feeds through a pipe; water returns to exhaust through the housing



Coil-spring clutch allows the propeller to slip if it strikes anything, then resets



Dual carburetion, to give high speeds or smooth trolling, is a sales feature that adds little to cost. The low-speed side is well heated to get good fuel vaporization

NEWS OF METALWORKING

Lagging Iron and Steel Scrap Drive Brings White House Edict to WAA

WASHINGTON—The White House, seeking to bolster the urgent iron and steel scrap drive, is putting new pressure on War Assets to find and offer for sale all available iron and steel surplus equipment, including "obsolete machine tools," other equipment, and residual steel inventories.

WAA has been offering over-age, highly special, and damaged machines all along, on a bid basis for scrap, but public mention in a statement by Presidential Assistant John R. Steelman, who again takes a hand in the lagging scrap drive, will not be overlooked by the surplus agency.

Steelman Seeks 1,250,000 Tons

Steelman said that between July and February, government agencies produced 1,000,000 tons of iron and steel scrap, and called for 1,250,000 tons during the remainder of 1947, exclusive of quantities to be returned from overseas battlefields.

But the federal agencies themselves can give no assurance that Steelman's hopes will be realized. WAA expects to deliver about 300,000 tons in the next two months, but after that it will be scraping bottom.

Military Supply Dwindling

After the Army turns in about 50,000 tons from domestic depots during March and April, its production during the rest of the year will be a mere trickle. Navy in the same period will deliver about 50,000 tons, and dry up. The military is short of men and money for producing scrap.

Views on Rubble Scrap

During the next few weeks the Army is expected to generate 150,000 tons in Germany, but foreign purchasers can get it by substantially outbidding Americans. Some U. S. commanders in Germany don't think it's fair to sell bombed-city rubble scrap to this country; they believe the Germans own it, and certainly need it.

The U. S. ship-breaking program, now in high gear at 50,000 tons per month, is the only source that can be relied on for steady return through this year and part of next. It is possible that some agitation may arise to curtail this program.

BILL TO DROP COPPER TAX FACES FIGHT IN SENATE

WASHINGTON — A bill passed by the House to suspend the 4¢ excise tax on raw copper imports faces a fight in the Senate. Western mine delegations oppose the suspension in fear of its future effect on domestic prices, and on their production subsidy. They demand a duration limit of one year, whereas consumers are asking for three years.

Domestic price is now about 21.5¢, world price 23¢, plus 4¢ tax. Effect of the suspension will be to create a single price somewhere in between 21.5¢ and 23¢.

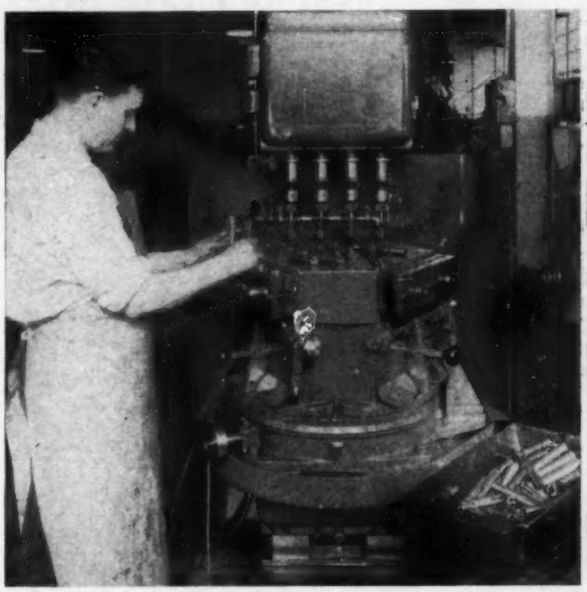
The import tax suspension will bring in substantial quantities of copper, but will not meet the country's 500,000-ton deficit in 1947. Proposal to drop the import tax does not cover copper products.

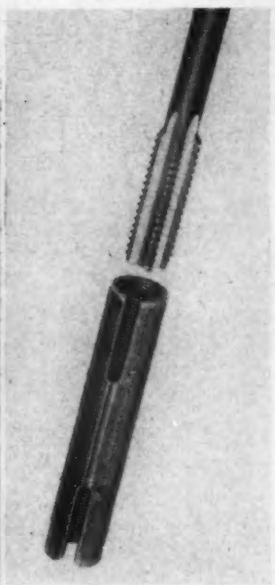
Bill to Clarify Professionals Under Wagner Act Wins Support

WASHINGTON — Six engineering societies have thrown their support behind Sen. Joseph H. Ball's proposed amendments to the Wagner Act which would guarantee separate status for professional employees in bargaining with management.

In testimony before the Senate Labor Committee, they specifically endorsed sections of Ball's bill (S. 360) which would assure professional and socalled "junior" professional employees the privilege of forming their own bargaining unit, selecting their own bargaining agent, separating themselves from non-professionals, and refusing union membership without jeopardizing their job.

The societies are: American Society of Civil Engineers, American Society of Chemical Engineers; American Society of Electrical Engineers, American Society of Engineering Education, American Society of Mechanical Engineers, and National Society of Professional Engineers.





Tapping Un-drilled Holes—Thompson Products, Detroit, taps cold-rolled SAE 1020 turnbuckles at rate of 12,000 pcs. in 24 hr. Two machines (right and left hand) furnished by Detroit Tap & Tool automatically clamp and unload at 4 stations. Detroit Tap also supplied "M-11" 11/16-18 taps (special chrome-cobalt, high-speed steel) which tap the 2¼ in. deep holes at speed of 250 sfpm. and yet give 500 pcs. per grind

Gaging Business

Steel Sets New Peacetime Record

Steel ingot production has been pushed up further to 96.4%, or the highest peacetime rate ever known. This achievement has been made possible by increased use of pig iron in place of scrap, prices of which have set new ceilings. Steel mills are turning out raw steel at the record level of 85 million tons a year. In the face of the unprecedented demand for sheet and strip steel, these products are being made at a rate of some 1½ million tons a month. By the end of the year added mill facilities will permit production of 20 million tons of flat-rolled steel a year. Many steel men still are of the opinion that the worst of the heat on the industry will be off by early fall.

More Than 5 Million Units Likely

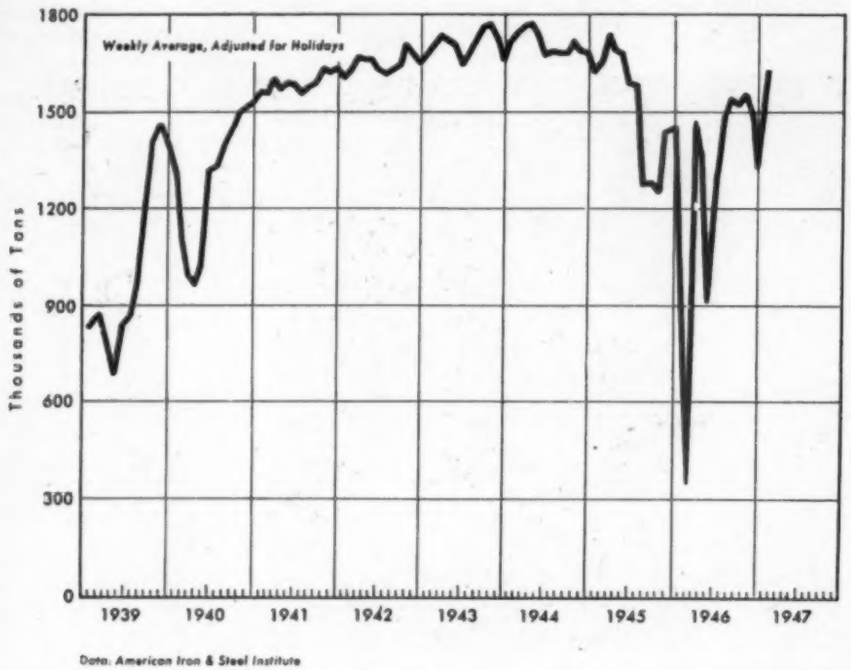
Automobile assemblies have finally got back into prewar stride. Output for the year is likely to be more, rather than less, than 5 million cars and trucks, especially if labor peace continues. Unless competitive conditions make model changes imperative, some motor car makers intend to go through 1947 without interrupting production. Retooling for one important company, for example, normally requires $15 million, but with costs where they are today, retooling would mean an outlay of $30 million. This company wants to avoid this expense if possible.

Shortages Still Troublesome

Metalworking companies are rolling along at an all-time high in production and employment of manpower, if the war years are excluded. Main concern still rests with shortages of materials. Pig iron, scrap and castings head the list, though copper is very tight too. Dearth of freight cars adds to the perplexing problem of trying to get enough materials to the right place at the right time.

Castings Demand Terrific

The squeeze on the makers of castings is terrific. They are having trouble, on one hand, securing pig iron, which steel people are using in greater quantities, and are being pressed by customers for increased deliveries, on the other hand. Reports are current that in at least a few cases an excess of steel is being accumulated by certain users as a protective cushion in case mill deliveries might be interrupted for any reason whatsoever.



Steel Output Hits Postwar Peak—Outlook for steel supplies is now the brightest since the war's end. Output rebounded to a new postwar high in January, tapered off slightly last month, but will likely be up again this month. The current rate is estimated at 30% higher than the 1946 strike-shrunk average. Production might balance off with demand soon

Car Cash Sales High

Automotive retail sales have been running as high as 85% for cash, reports one large company. The ratio of cash to installment buying continues to surprise the industry. An increase in time sales, however, is looked for soon. Sharp differences are voiced in automotive circles as to how long cars can be sold in huge volume at current high prices. Price resistance is showing up now in the availability of certain "makes" for almost immediate delivery.

Deliveries Held Up

Deliveries of many metalworking products are being held up for lack of one or two short items. A maker of fan equipment, for instance, is not able to ship a $50,000 order because he cannot get $185 worth of malleable chain. A worse case is that of an aircraft parts maker who cannot deliver $300,000 worth of goods because he cannot secure necessary ball bearings costing a few dollars.

Machine Tool Sales Off

Machine tool sales have been slipping off lately. This has been more true of general-purpose machines than of special-purpose, but some slackening is noticeable even in the latter category. Though competition from government surpluses at low prices is partly responsible, the postponement of new tooling programs by the automotive industry has been a depressing factor. Normally automotive customers are the biggest source of domestic machine tool business. Decisions to make few changes in '48 models and delays in later new-car plans have hurt machine tool sales.

Tool Shipments Hold

Shipments of machine tools from factories have been keeping up to levels prevailing in recent months. Little if any letdown in production is anticipated in the immediate future. If some of the automotive tooling programs now in the development stages should be let loose, many machine tool companies would have their hands full almost over night. Deliveries of many standard types of machines can now be made in three to ten weeks, but large machines, such as planers and boring mills, are being quoted in numerous cases for 12-months' delivery. Recent foreign orders have disappointed the industry, having fallen off recently from the high level of almost 30% of total business booked.

Chicago Fabricators Jam Warehouses With Finished Goods in Rail Tieup

CHICAGO — Metalworking firms in the Chicago area are faced with a growing shortage of railroad cars that is already having an adverse effect on output. At least one-half the shippers in the district, a survey shows, are not getting an adequate supply of cars to meet their daily needs, and practically all shippers are meeting delays in the transit time of freight.

While box cars are the scarcest item, all types of rolling stock are in short supply. Daily shortages of representative firms range from 10 to 60 per cent of freight car requirements. Shipments are delayed to the extent that the average length of time is twice as long as before the war for typical hauls.

Thus far major production cuts have been avoided by making maximum use of storage facilities for finished goods or for materials ready for shipment. If the car shortage is not eased soon, however, storage facilities will be jammed and output slashed.

Embargoes Invoked

In addition to the shortage of cars, leading railroad lines, to clear up car congestion at Chicago, are invoking embargoes on receipts and shipments of less-than-carload freight. These actions have also hampered metalworking concerns, and have resulted in a boom in the business of truck lines. These lines, however, cannot handle the sudden rush of business, and are not anxious to take "lcl" shipments because they say they are carried at a loss.

Another factor in the tight railroad situation is emphasized by some rail executives. They say that the western roads, operating out of Chicago, are unduly hampered by the car shortage through the national car distrtibution plan, which results in many cars owned by western roads spending much time on eastern rails.

Shortage of 300,000 Cars

A picture of the effect of the car shortage on midwest firms will be presented to the Interstate Commerce Commission by the Mid-West Shippers Advisory Board, which is compiling complete statistics on the problem.

Right now car builders estimate there exists an over-all shortage of 300,000 cars of all types. While output will be stepped up immediately, a production of 10,000 cars a month (with simultaneous junking of more than 5,000) will require at least two years for any substantial easing of the shortage.

Use of Aluminum Urged

Meanwhile aluminum producers in the Chicago area are suggesting that aluminum be used in fabricating bodies, roofs, framing and other upper-structural car parts. They assert that every standard 40-ft. box car built with wheels, axles, and understructure of conventional iron and steel but with a box and roof of aluminum would release for other uses about 13,275 lb. of sheet steel. Reynolds Metal Co. has already built a car of this type. Aluminum Co. of America is also interested in the business.

Rise in Pig Iron, Scrap Prices Overshadows High Steel Output

PITTSBURGH — Increases in pig iron and scrap prices within recent weeks have tended to overshadow (1) demand for steel products is unabated, and (2) the best postwar quarter in ingot production (January-March 1947) will be considerably shy of the 22,600,000 tons turned out during the first quarter of 1944.

Compared with last year, of course, there is a vast increase because the industry was flat with a momentous strike during January-February 1946.

Two factors combined in the first 1947 quarter to prevent even higher output. One was a scrap shortage, and the other was a series of natural gas shortages which gyrated steel ingot output at a number of plants in the Pittsburgh-Youngstown district. The latter affected finished steel production, and prevented some semblance of balance between supply and demand.

Scrap-Price Spiral

Scrap prices have risen until, at this writing, open-hearth grade is at a minimum of $38 per ton here, and the average is probably higher because of greater prices paid for the so-called remote scrap purchased. Charging of such high-priced scrap into smelting furnaces lessens the profit margin. Furthermore, the inflationary effect of scrap and pig iron advances is being noted. The desire for higher prices by purveyors of raw materials spreads.

Because of the natural gas situation, the average ingot producing rate in Pittsburgh during February was 98%. This compared with 91.9% for the nation and reflects the ability of the Pittsburgh area to utilize much of its productive facilities despite shortages. The natural gas shortage affected the local plant of American Steel & Wire Co. principally, and curbed production of much-needed wire products.

Ingot Capacity Held Ample

While finishing mill capacity is in excess of ingot capacity, there is no desire on the parts of management to increase primary capacity because of the cost and belief that present ingot capacity will be about right a year from now.

Tour of Pacific Coast Companies Reveals Expansion is Top Subject

SAN FRANCISCO — Two weeks spent in the major industrial centers of San Francisco, Los Angeles and San Diego observing operations and talking to plant executives showed that the keyword on the coast is "expansion," both in plants and variety of subjects. The National Association of Manufacturers and California Chamber of Commerce sponsored the tour.

One exception to this appeared in aircraft and shipbuilding operations, but everywhere work is far above the 1939 level. And in some companies, such as Solar Aircraft in San Diego, a switch to such items as stainless steel milk trucks, motion picture developing equipment, stainless steel coffins and other peacetime products has brought even higher employment than in the highest war year, according to company officials.

Shortages of materials continue to be the main problem confronting metalworking shops—materials both for production and construction of plant expansions. Steel, or parts made from it, is the basis for most of the worries. There are still a few other shortages but in general plant operators feel the worst is over. The long pull for steel looks bright to Westerners, but they expect it to get worse before it gets better.

Production Aspects

Friden Calculating Machine Co., San Leandro, has yet to curtail production because of lack of precision cold-rolled steel strip, but they are pessimistic about the future. The McKee Electric Co., Bakersfield, manufacturers of Lok-Cynch hose clamps, has curtailed its output for lack of galvanized strip.

Lewis Decision Keynotes Labor Peace; Paves Way for Increased Production

NEW YORK—Decisions by the U. S. Supreme Court in the John L. Lewis and Packard foremen cases can be expected to have important effects on industrial labor relations during 1947. The first materially lessens any possibility of crippling strikes; the second means that management must expect greatly intensified efforts to unionize foremen.

▸ Metalworking industry employers have generally written off the likelihood of major tieups in the steel industry this year. They have had encouraging reports about prospects for peace in nonferrous metals and other allied industries. Their one big concern has been John L. Lewis' United Mine Workers. Industrial production hinges so firmly on a steady output of coal that a mine strike almost immediately means broad shutdowns throughout industry.

Clears Air for Negotiations

When the Supreme Court handed down its decision—in a surprise move that emphasized the importance justices attached to it—wide concern ebbed. Clearly, the door to strike action had been slammed shut in Lewis' face—at least for a period of four months, probably for the whole of 1947.

▸ Significantly, that was interpreted throughout industry as meaning that negotiations in steel, automotive manufacturing, and other important lines can now go ahead. And unless employers and unions make an unexpected botch of negotiations, it means that industry can count on months of big-scale production without the harassment of labor strife.

Quick Settlements Expected

With raw material shortages being overcome, that is important. It means a period of rising production and good profits.

▸ Likelihood now is that quick settlements will come in steel and automotive collective bargaining, and that the wage increases will run around 12¢ an hour.

▸ The Supreme Court decision in the Lewis case gave the government unexpectedly strong backing for its common-law contentions that it may restrict the right of its employees to strike. Government attorneys had argued that Lewis' coal miners became government employees when it seized coal mines last year. They contended also that under old English common-law, still recognized by the courts, the government is entitled to enjoin its employees from strikes in violation of their contract.

Far-Reaching Effects

While the decision in favor of the government applies, for the moment, only to the miners' case, it can have far-reaching importance. Congress has been probing, with debated success, for a sound legislative vehicle for barring paralyzing strikes in industry. The Supreme Court may have pointed the way: establishment of the right of government seizure in disputes involving a threat to the common welfare. Henceforth, or until limited by the high court itself, that means designation of employees as "government" workers who can now be barred from striking through injunctive methods.

Foremen Decision Causes Concern

But while the Supreme Court was relieving some labor worries in its Lewis decision, it was posing new management problems in one covering Packard Motor Co. foremen.

▸ This decision upheld the right of supervisory employees to claim National Labor Relations (Wagner) Act protection and to become members, for collective bargaining purposes, of the independent Foreman's Assn. of America. Packard management had claimed that foremen and other supervisory employees were a part of management, hence were not covered by the act. The court rejected this argument.

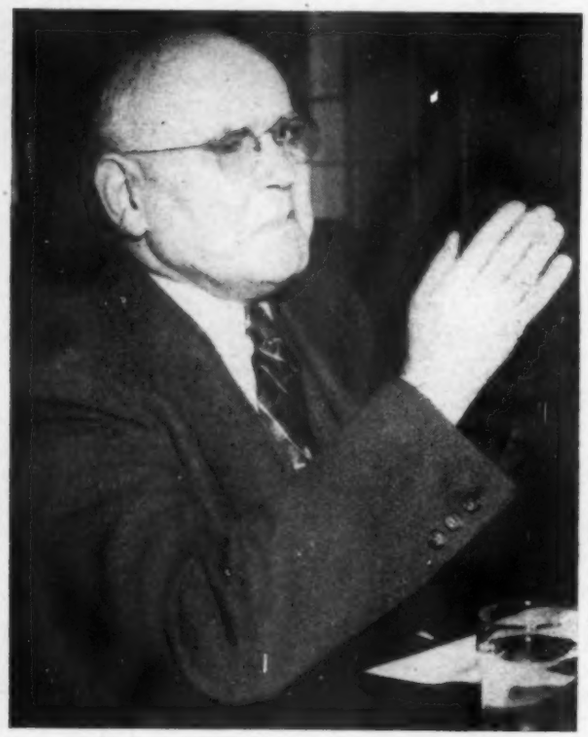
Legislative Barrier Considered

In doing so, the court gave the FAA a clear track—for three or four months—for an intensive foreman unionization drive. There is every prospect that Congress will vote later in its current session to bar this unobstructed course with some specific limitations on supervisory unions. Probably this will be a new law which clearly defines foremen as a part of management, and which will emphasize that they are not to be considered as covered by the Wagner Act. That will pull foremen unionization drives up short, but will not stop them completely.

▸ Instead, it is probable that such legislation will force supervisory union attempts back into a pre-Wagner Act pattern. Organization and recognition will be gained by militance, through strikes if necessary, instead of the more peaceful National Labor Relations Board election method.

Foremen Reaction Awaited

Unionization will be at a slower pace (foremen will have some hesitation about joining a union if they will have to strike to get it recognized) but it will at the same time be more of a concern to management than now. Supervisory unions and their members will have to be considered as strike-minded. They will have the support in most instances of rank-and-file production workers.



Labor Debate — Controversy over labor legislation has been running rampant in Washington ever since the 80th Congress convened. Van A. Bittner, chairman of the CIO organizing committee, is shown here at a recent House Labor Committee meeting at which he accused members of having a closed mind and stated that they will "not give labor a fair break"

Detroit

MAJOR AUTO TOOLING PLANS STILL UNCERTAIN . . . ONE LARGE FIRM CHECKS AVAILABLE TOOLING TIME . . . PAYROLL PEAK SEEN FOR MAY

Tooling Orders Scattered

Tooling programs continue at desultory levels in the Detroit area. Some scattered work has been placed by various automobile companies, but not enough to bulge the schedules in the tool shops. Machine tool makers, likewise, have nothing in immediate sight of real consequence.

Survey of the Detroit shops, as a matter of fact, indicates that upwards of half the work being done is for non-automotive application, with agricultural implement and electrical goods makers accounting for the larger share. There are some indications that many ambitious automobile plans for 1948 models may be completely shelved until 1949, just as they were put over once from 1947 to 1948.

Plant Operations Stabilize

If any balm is present in the situation, it stems from the inquiries coming currently from one of the largest auto producers. The firm is checking on available tooling time starting at once and extending into the summer. If these inquiries translate into active order placing, the present dull Detroit picture may sharpen up noticeably.

In line with today's activity among equipment makers, employment generally in Michigan is somewhat lower than at the close of 1946. In one respect, this stems from the more stabilized plant operations at most automobile plants. As they reach equilibrium, the need diminishes for marginal employees required during transition periods.

Increased Work Forces Seen

Looking ahead, however, employment analysts figure that upturns promised in the spring may result in a new Detroit area peacetime payroll peak by May. One well-based estimate is that 1,060,000 persons may be at work in the area then, as compared with September, 1946, when 1,055,000 had jobs. Today's figure is somewhere around 1,035,000.

Larger work forces could logically be expected if automobile production projections come true. Today's steady rates just above the 100,000-unit-a-week mark seem slated for expansion in the middle spring, when somewhat better flows of tight materials are expected.

Bliss Re-equips Press Plant

E. W. Bliss Co. has reported itself pleased with the results of the recent move of its Brooklyn executive headquarters to Detroit. With over 60% of its shipments to midwest industry, the company finds its new location increasing its contact with outlets in the automotive, domestic appliance, electrical, and steel industries.

The big Bliss press plant at Toledo, meanwhile, is in the late stages of an extensive re-equipping program for maximum production of medium and large power presses. Included in the activity is the installation of some $300,000 in new machine tools, including four large horizontal boring and milling machines, one large vertical boring mill, three medium milling machines, two medium vertical boring mills, and smaller machines. New material handling equipment and intra-plant trucking facilities are also being provided.

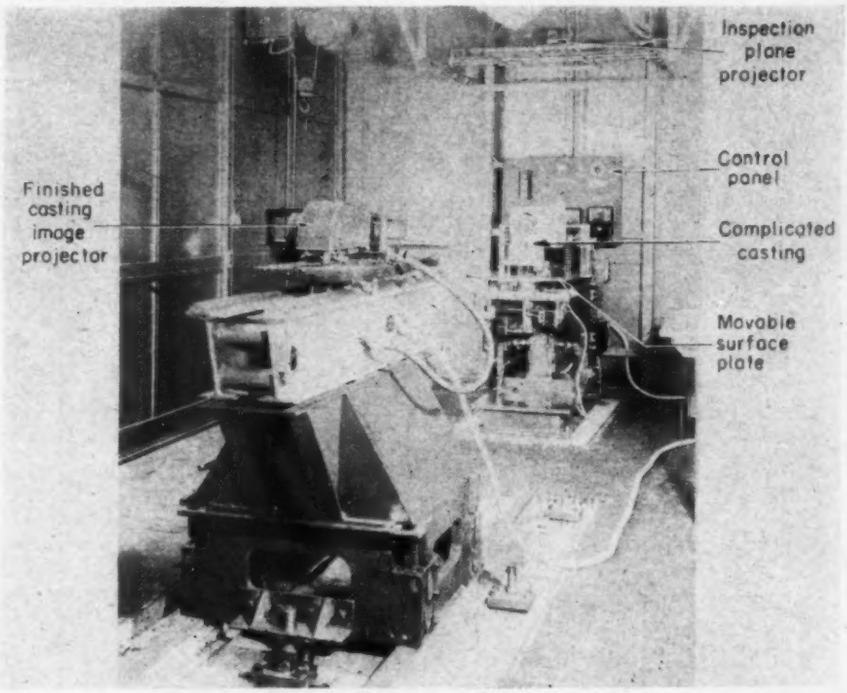
Plant Layout Revised

Plant layout has been considerably revised to fit the larger production capabilities of the new machine tools.

The Toledo plant backlog, company sources reported, stands today at about 10 months' production. The volume of work at hand has resulted in widespread search for machine tool operators and assemblers for a second shift, and for foundry help of all types. Future expansion programs may hinge on the availability of such manpower.

Ford Expands Steel Mill

On the score of expansion, Ford Motor Co. is making several additions to its steel mill at Dearborn. Mold preparation, stripping facilities, and a 1-story addition to the cold steel mill are going up. Production capacity will not be increased, but better balance will be achieved between capacity for cold rolling and steel requirements, both at the Rouge plant and outside body manufacturers supplied by Ford. A new 250-ton traveling stripper crane has been installed from an overhead crane. It either removes the ingot from the mold or the mold from the ingot, depending upon the type of mold used.



Layout By Light—Thousands of intricate castings have been laid out and inspected with this 3-dimensional projection equipment developed by G.E. engineers at Pittsfield. The equipment, handled by unskilled operators to an accuracy of 0.015 in., saves time and material. A layout drawing of the part is photographed to microscopic accuracy on a glass slide. This image is projected by a lens directly on the surface of the casting (mounted on a surface plate adjustable in height), the plane of true projection and correct dimensions being established by a "light wand" or plane-of-light projector at right angles to the first. The two projectors operate automatically in unison under selsyn control. This system can be used to position layouts or intricate castings, to lay out holes or other elements for flame-cutting or shearing, or even to project a templet for control in machining a symmetrical revolving piece or a stationary one

New Demands for Steel Indicate Need for Full Output During Year

PITTSBURGH — While most consumer pressure for steel involves near-term deliveries, there is an equal willingness to place orders for some period ahead. New demands and priorities (the latter on a voluntary basis) indicate full steel production will be necessary throughout this year.

The argument, therefore, is that it is safe to maintain a strong steel inventory at all times during the current year and in certain items there will be shortages for more than a year.

Freight Car Quota High

The steel industry has committed itself to a very large freight car program which, if pursued to its ultimate course, can only be accomplished by taking steel away from other types of consumers.

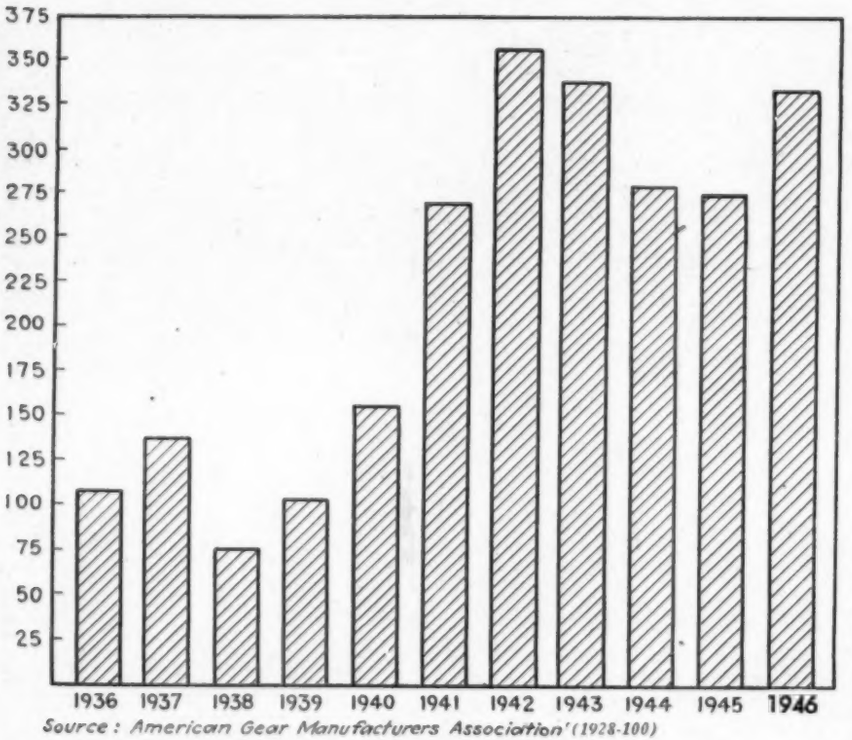
Structural steel interests claim there is no hope of all building being accomplished this year because of steel shortages.

Meanwhile, a hungry export market is willing to take all the steel, apparently, it can get and often obtains tonnage in unorthodox ways.

Price Thinking Revised

The rise in the prices of pig iron and scrap—particularly the latter—may cause revised thinking in respect to the outlook for steel prices.

Heretofore, there has been a belief that the steel industry could afford to relieve its consumers of some of the extras being charged and still be able to meet a wage increase which is the manner in which many still expect the steel labor problem to be settled.



Source: American Gear Manufacturers Association' (1928-100)

Gear Production in '46 Hits Peacetime High—Only the two wartime years of 1942 and 1943 showed a higher production of gears, exclusive of turbine or propulsion gears, than the 332.5 index figure for 1946. In the peak year of 1942 the production rate was 355.5, while in 1943 it dropped to 336.5. The highest pre-war year was 1940 with a total of 155, while 1929's boom produced only 128.5

Emergency Standby Clause Used In Sale of Surplus Brass Plant

WASHINGTON—First sale of a war surplus ordnance brass plant, with security clause requiring purchaser to keep it in standby condition for emergency, is nearing conclusion with Bridgeport Brass Company, Indianapolis, Ind. Price under negotiation is about $4,000,000.

The company, whose main plants are at Bridgeport, Conn., plans to spend $2 million on facilities to enable the Indianapolis plant to turn out brass sheets and tubes in commerical sizes. Under agreement with Ordnance Department, standby equipment can turn out 450,000 105 mm. shell cases per month and 8 million lb. of .50 and .30 caliber brass cups per month.

War Assets told *American Machinist* several brass plants have been *leased* under security agreements. The Indianapolis plant cost $11,500,000, received equipment worth $4,500,000 for making steel shell cases, and was appraised by Ford, Bacon & Davis at a fair value of $5,100,000.

Automatic Inspection System Shown Mid-West Industrialists

CLEVELAND — Arma Corporation of New York, removed the wraps from its automatic inspection system here this month and demonstrated to some mid-western industrialists the saving in time plus a higher efficiency in checking and testing parts up to 1½ in. that can be had through use of its devices.

Bearing the trade name of "Limitron," the testing device is three machines combined into one—the gage head, which measures to 1/10,000 of an inch, the classifier which sorts inspected sizes into correct, over, and under sized, and the electronic controls which is the brains of the machine in that it transmits by electronic impulse from the gage head to the classifier the proper gate to be opened to receive the inspected part, at the same time giving an accurate count on the number in each of the three classifications.

Dome-type Rail Cars to Enter Service on Burlington Route

PHILADELPHIA—The Budd Vista-Dome passenger railroad car, a new stainless steel type, will make its first appearance in late June or early July on the Chicago, Burlington & Quincy RR. The railroad officials witnessed testing of the Vista-Dome coach at The Budd Co. railway car test laboratory recently.

The Vista-Dome offers enticing observation area for passengers. Orders for 49 Vista-Dome cars are now in from a number of railroad lines, and The Budd Co., has expanded its production to meet the demand.

Washington

CLOSE-OUT PROGRAM ON SURPLUS ITEMS CONSIDERED . . . RFC CHECKS LEASED TOOLS . . . SHIPBUILDING IS ON WANE

Status Quo on Fixed Prices

Addition of a third group of surplus machine tools to the fixed price register apparently is not now under contemplation. Statements to that effect by War Assets officials are taken at face value by responsible persons in the machine tool industry. These persons feel that WAA will not create a third category at least until after a new surplus tool close-out program has been agreed upon and put into effect. It would be unreasonable to expect that an agency dealing with such nebulous forces as those involved in the huge war surplus, could make long-term commitments, except in principle.

Further inquiry again confirms AMERICAN MACHINIST'S previous report that War Assets is seriously considering the close-out program proposed by leaders in the tool and equipment industries. That proposal calls for greater military reserves of surplus tools; aggressive donation programs to schools and colleges; and more pressure on exports. Inevitably, a large portion of the surplus tools stock will be sold for scrap. Persons interested in purchase of surplus machines are assured by WAA that prices of tools now listed in the first and second fixed price registers will be applied until all of those tools are sold. This assurance has been repeated several times.

RFC-Owned Machine Tools

Reconstruction Finance Corp. has been criticized for not offering for sale the large volume of machine tools which it owns and which are now on lease to operators of government plants in which the tools are located. In reply, RFC explained to AMERICAN MACHINIST that last October it addressed a letter to all such lessees of tools, notifying them that if they did not reach a decision regarding purchase of the machines within 60 days, RFC would feel free to declare them surplus to War Assets. As a result, many of the tools have been sold to lessees, and many have been declared surplus. RFC sources say they believe some of the tools earmarked as surplus are still on lease on an interim basis. The volume and status of RFC-owned machine tools will be subject of a report in these pages at an early date.

Air Force Claims False

Military Air Forces, especially the Army, may soon be publicly charged with planting false hopes in the public mind by announcing performance figures which their new airplanes cannot actually meet.

Latest complaint is that the AAF's twin mustang fighter, "Betty Jo," in a record run from Hawaii to New York (1) could not possibly have increased it fuel range 20% by use of drop tanks as claimed; (2) that its range certainly would be substantially reduced by addition of armor and armament, contrary to claims; and (3) that AAF defaulted several starts from Hawaii, not waiting for good weather, but for favorable winds.

Engineers charge also that AAF's jet fighter, the P-80, has a top speed nearer 500 mph. than 600 mph.; that the rocket plane, KS-1, can barely equal the speed of sound and has no chance of reaching 1700 mph.; that AAF has admitted in writing that it misinformed the public concerning the duration run of the B-29 Dreamboat.

Wright Field engineers are disgusted when they have to admit to superiors that their planes cannot match publicity claims. They say the Navy too is guilty of exaggerations. It's pre-Pearl Harbor again, and the gullible taxpayer is not getting what the military press agents advertise.

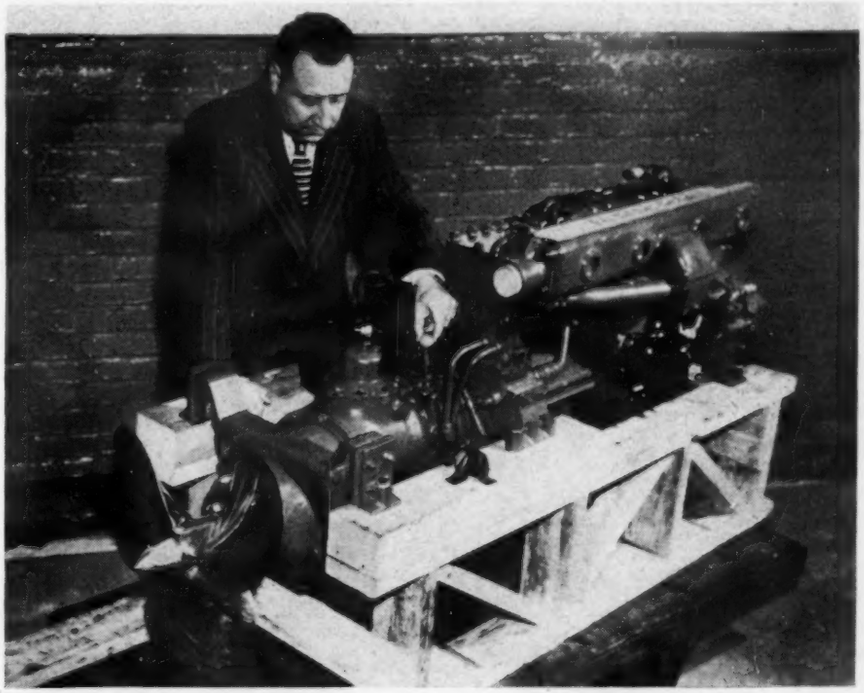
Passenger Shipbuilding Lags

The United States is practically out of shipbuilding, with only 64 vessels under construction, while Britain is building 454, Holland 91, Sweden 66, Norway 62, and France 58, and even bankrupt Italy 87.

These foreign ships are all under contract or construction, according to Lloyd's of London. Of course some of them are small, especially those in the Italian yards.

President Truman's newly-appointed Merchant Marine Advisory Committee, all non-shipping men, will recommend means of re-instating the U. S. in shipbuilding and of keeping it in the ocean passenger business, most of which is already lost to foreign lines. The Maritime Commission has only enough money left to build and subsidize 9 more ships under the act of 1936.

In an effort to blast appropriations from Congress, the Commission, and presumably the President's committee, will argue passenger ships are a necessity for troop transport.



Packard Marine Engine—One of two marine engines, featuring finger-tip control reverse gear, that will be on display at boat shows throughout the country this spring, is shown nearly ready for shipment. This "Packard Marine 8," a hand-built model, is being inspected by Stanley A. Milock, manager of the Packard Motor Car. Co. commercial sales department and in charge of all marine engine sales. The other model is known as the "Packard Marine 6"

Metalworking Expands in Sweden

Expanded machine tool plants in Sweden are working at top speed to meet unprecedented demands for new equipment

STOCKHOLM (McGraw-Hill World News)—Sweden's metalworking industries are today booming more than ever before. There is business ahead for years to come, and most plants are running at high speed, limited only by shortages of materials and labor.

Inadequate production facilities in the face of excessive demand have induced inflationary tendencies. Plant enlargements and mechanization have led to pressure for more investments. This pressure is having particular effect on the machinery-building section of the economy.

Increased Machinery Purchases

Between 1945-1946, outlays on purchased machinery rose from 237 million kroner to 372 million kroner, or by 57%, with a further increase during the current year estimated at 28%. (The unsettled dollar value of a krona at this writing was about 27c.

These figures suggest the major part of typical postwar machinery investments were concluded in 1946. Considering that the share of export orders—now up at one-third of orders on hand at the mechanical industries—are rising steadily, there is little doubt excess demand for new machinery and equipment will last for years to come.

The order reserve of the mechanical workshops was more than doubled between Feb. 1945 and Oct. 1946. For the industry as a whole, it would provide full production for 17 months ahead, but differences between individual lines are great.

Backlogs High

Orders on hand are highest at shipyards and electrical plants, permitting full production for 32 and 25 months, respectively. Orders are lowest at motor and automobile plants, representing an estimated 9 months of their production capacity.

Despite tremendous order backlogs, Swedish manufacturers are encountering rough spots. Many firms in the mechanical and allied industries are unable to obtain supplies of steel, spare parts and other materials. The Volvo Corp., Sweden's largest motor car builder, has launched a postwar program for 20,000 cars and trucks annually, as against a prewar figure of 7,000. Last year, however, actual output was little more than prewar. Other manufacturers, facing partial plant shutdowns, claim the supply situation is worse than at anytime during the war.

While the mechanical industries have lost a relatively low percentage of their workers, the labor situation is critical. Competition for labor makes for difficulties. Recent reports indicate mechanical workshops are short 13.1% and 26.4% of their present force of male and female labor, respectively.

The defense program and curtailment of imported supplies resulted in much expansion of metalworking plants. This was true particularly of those producing machine tools, electrical equipment, agricultural machinery, instruments and office machines. This suggests the Swedish degree of self-sufficiency increased about one-sixth of prewar needs of mechanical products.

Industrywide Expansion

The machine tool industry accented wartime expansion operations. A little more than a decade ago, it was represented mainly by two large concerns, Bolinder-Munktell and Köpings Mekaniska Verkstad and a few small manufacturers.

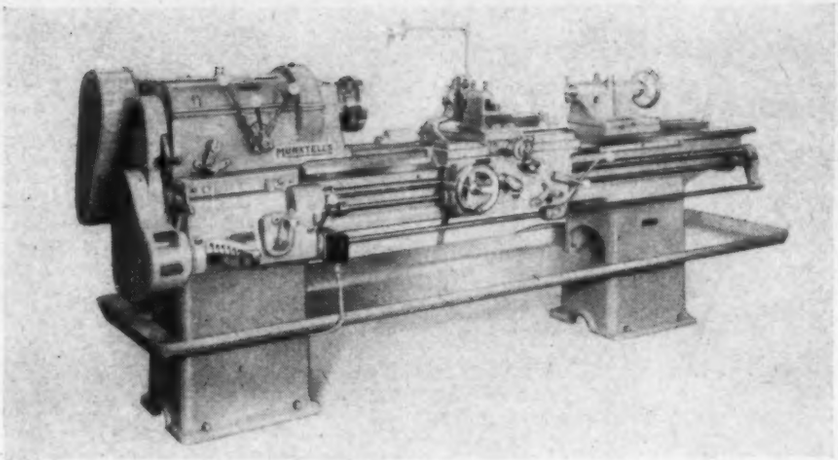
During the Thirties, this industry attracted a number of other companies. Arenco Corp., maker of tobacco machines, entered the field in 1932, followed in 1934 by Svenska Turbinfabriks A. B. Ljungstrom, and in 1936 by the ASEA.

At the war's outbreak, a steady, though moderate, expansion was underway. This was brought about by heavy demand for conversion of metalworking industries to the armament program, and the halt in imports of foreign machine tools. Well established firms increased their traditional lines and developed new types, etc. One company, Lidköpings Mekaniska Verkstad, built machine tools on license from Norton & Co., and Warner & Swasey, U. S. firms.

With the influx of new companies, the list of machine tool manufacturers in Sweden has grown to 30. Many are comparatively small enterprises. Not too many of the firms

MAJOR SWEDISH MANUFACTURERS OF MACHINE TOOLS

Company and Location	Type of machine Tools Produced	Capital (kroner)	Working Forces
A. B. Arbogamaskiner Arboga	Drilling machines	500,000	400
Göteneds Mekaniska Verkstad, Götene	Screw-cutting lathes	180,000	65
Köpings Mekaniska Verkstad, Köping	Lathes, milling machines	1,500,000	300
Lidköpings Mekaniska Verkstad, Lidköping	Centerless cylindrical grinding machines, surface grinding machines, tool grinding machines, turret and capstan lathes	1,500,000	750
A. B. Jocknick & Norrmans Mekaniska Verkstad, Värnamo	Shaping machines	100,000	45
Mildens Elektriska Motor A. B., Sundbyberg	Electrical drilling and grinding machines	42,000	50
A. B. Rosenfors Bruk Rosenfors	Milling machines, high speed lathes, drilling machines	250,000	175
Falköpings Mekaniska Verkstad, Falköping	Screw-cutting and high speed lathes, various types of drilling	150,000	50
Stavsjö Bruk, Stavsjö	Screw-cutting lathes and eccentric presses	———	—
Hultfreds Mekaniska Verkstad, Hutsfred	Screw threading machines	———	45
Eklunds Mekaniska Verkstad, Stockholm	Milling machines	———	—



Typical of Swedish Machine Tools—This Bolinder Munktell high-speed lathe varies little from U. S. models. Made of Swedish material throughout, it has 12 speeds for forward and reverse operation. Accessibility of controls is a feature. The turret tool block and coolant equipment are extras

can be considered as confining their operations to production of machine tools.

Between 1939 and 1943, the value of machine tool production rose from 12.6 million to 36.2 million kroner. Allowing for a considerable increase in costs and prices, there is still good evidence that machine tool production more than doubled in volume during that period.

Foreign Trade Decline

Foreign trade always played a great role on the Swedish machine tool market. The accompanying table shows imports slightly exceeded the output of domestic manufacturers. But, one-third of the domestic production was shipped abroad. In 1945, imports were reduced more than exports, effecting an export surplus.

Sweden's Foreign Trade In Machine Tools
(millions of kroner)

Imports		Exports	
1939	1945	1939	1945
13.1	4.1	8.5	7.3

In 1939, Germany and the United States, in that order, were primary sources of supply. Switzerland replaced Germany in 1945, with the U. S. still holding second place. Prior to the war, European nations were the most important export markets for Swedish machine tools, with Great Britain and Germany topping the list.

In 1945, Europe still predominated but some new customers were added, such as Turkey and South American markets, particularly Argentina. Most Swedish machine tool builders engage in export business, one way or another.

Import and export business in machine tools attained a higher level in 1946 than ever before. Rough estimates indicate imports will have come to approximately 30 million kroner, and exports to about 23 million kroner. Lith imports increasing much more than exports, the normal pattern of import surplus was restored.

The U. S. seems to be a substantial supplier of imports. Some business was done in used machinery, and there were also some reexports of American machines to countries in Eastern Europe. Foreign machine tools have brought high prices.

Australian Traders Offer Bids For $3,300,000 in Cutting Tools

MELBOURNE (McGraw-Hill World News)—Tenders closed last month for the sale of $3,300,000 worth of cutting tools which the Commonwealth Disposals Commission (Australia's WAA) offered to parties capable of proving they had overseas commitments.

Resale of the tools in Australia is precluded by terms of the tender, and no import duty will be collected on such wartime government imports. The measure has been taken to protect the domestic tool industry. Much of the equipment was originally obtained through Lend-Lease, and many traders hope to resell tools to U. S. firms.

The catalog of American made cutting tools offered for sale comprises 339 different items of new milling cutters, with 1,000 to 2,000 units available of many items. Upwards of 10,000 combined drills and countersinks of various specifications were offered, in addition to 246 types of drills.

There were 227 descriptions of taps, and 155 catalog numbers covering thread gages. Planing and knurling tools, tool shapers, boring tools, tool holders, cutting-off tools, drill sleeves, lathe centers comprised 121 different descriptions with up to 4,000 units available for each. The catalog indicated Australian-made tools duplicated British rather than American designs.

Shaping Machines are among the products turned out by Malma-Vibro. A worker is shown operating the shaper in a Swedish plant. The machine is started and stopped by a multiple-disc clutch. The baseplate and main frame are separate castings, cross-ribbed. All guides are of rectangular section

British Realize $100 Million Return In Sale of Surplus Machine Tools

LONDON (McGraw-Hill World News)—A total of 97,000 surplus machine tools of all types have been sold in the United Kingdom from the beginning of the British Government's surplus disposal scheme up to Dec. 31, according to Arthur Woodburn, Joint Parliamentary Secretary to the Ministry of Supply. This represents an estimated two-thirds of the total number of surplus tools; the rest likely will be disposed of by the end of this year. Total sales have realized $100 million.

Virtually every variety of machine tool has been available, but stocks of the types most in demand—such as universal milling and grinding machines and radial drills—have been small.

92,000 Machines to Industry

Most of the machines, 92,000, have gone to British industry. The rest have been distributed among such governments agencies as the Directorate of Atomic Energy, the Ministry of Supply's research development projects, and the Ministry of Fuel and Power for colliery workshops. A small portion of the surplus machine tools and measuring instruments, valued at $1 million, has been allocated to schools, universities, and various industrial associations' research activities.

In addition to machine tools, the Ministry's surplus disposals organization has sold surplus iron and steel stocks to the value of $50 million during 1946. Metals suitable for peacetime production were classed as reusable material, and 479,000 tons were sold to industry during the year.

Battlefields Supply Scrap

Other items were sold as scrap for resmelting, and with salvaged iron and steel scrap from the battlefields of North Africa and Europe, amounted to 1,546,000 tons and brought in $18,552,000. Salvaged iron and steel scrap collections from Germany alone amounted to 23,000 tons during the last quarter of 1946, and a further 240,000 tons from this source are hoped for during the first half of this year, which should replace scrap imported prewar from the U. S. A further source of scrap was 12,000 condemned machine tools.

A refining and rerolling program for non-ferrous metals was inaugurated in 1946. Brass scrap is being converted into rough copper and exported to overseas refineries; thick brass strip (originally intended for ammunition cases) for which there is little or no commercial demand, is being rerolled to gages.

Electrical Motors Salvaged

Surplus industrial electrical equipment to a total of $2 million has been disposed of. This has made motors and other necessary electrical equipment available to many factories 12 months or more before the normal delivery date of new equipment.

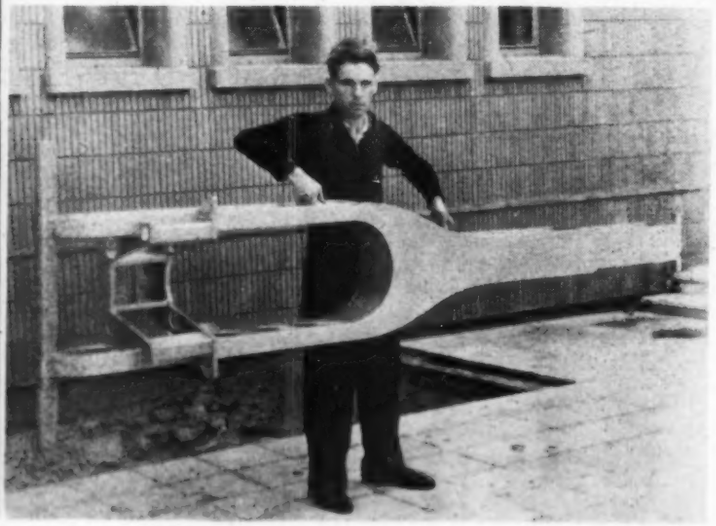
Some 13,000 portable generating plants have been sold along with welding equipment valued at $296,000, and portable electric and pneumatic tools which brought $408,000. Mobile generating stations of the turbo-alternating type representing a total of $6 million have gone to overseas buyers, especially China.

Surplus Vehicles Bring Return

Other large disposals of surplus goods include: 200 main line locomotives, 300 switching engines, and 3,000 tank cars. Over 80,000 trucks, cars and other vehicles have been sold by auction, bringing $29,760,000, and clearing out 26 of 33 vehicle parks established for this purpose.

Another 11,000 vehicles were furnished to UNRRA and other relief agencies, and others have gone to British colonies. In all, 195,000 vehicles, including motorcycles, have been turned over, realizing a return of $116 million. The services are expected to release between 100,000 and 150,000 vehicles as surplus in '47.

Last year, 1,600 surplus aircraft were sold for $7 million. In addition, some 2,000 surplus military aircraft have been sold to other nations. The rest have been marked for scrapping. Already some 80,000 tons of aluminum have been recovered, enough for 54,000 of the aluminum prefabricated houses currently being pushed by Government ministries responsible for housing.



Spot Welds for French Cars—A new unified weld-gun (left) is used for several operations on the Chaussen delivery truck. A worker (below) demonstrates lightness of a car chassis, made of spot-welded 2 mm. aluminum sheet formed into a box shape

Names in the News

Alvin L. Krieg

Alvin L. Krieg has been appointed assistant to the general manager of the National Machine Tool Builders Association, Cleveland. A former newspaper man, he was recently assistant to the director of public relations of American Steel & Wire Co. and previously was in charge of public relations for the Westinghouse Appliance Div.

Admiral Ben Moreell, president and chairman of the board of the Turner Construction Co., New York City, has been elected president of the Jones & Laughlin Steel Corp., Pittsburgh. He will continue as president of Turner until June 1.

W. F. Rockwell, Jr., former vice president and general manager, has been elected president of the Rockwell Manufacturing Co., Pittsburgh. He succeeds his father **Col. W. F. Rockwell,** who continues as chairman of the board.

Edmund J. McSweeney has been elected vice president in charge of manufacturing of The Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio. He succeeds **R. J. Whiting,** who has been with H-P-M since 1940 as works manager and vice president, but recently resigned.

D. S. Harder, vice president in charge of operations of the Ford Motor Co. and former president of E. W. Bliss Co., Detroit, has resigned as chairman of the board and director of Bliss.

Arthur E. Tulk, former executive vice president and general manager of The Cleveland Quarries Co., Cleveland, has been named president. He has been with the company since 1920 and joined the Sterling Grinding Wheel Div. when it was purchased in 1922. In 1939 he was made executive vice president and general manager of Sterling.

Fred Braumhoff has been elected president of the Idaho Steel Products Co., Boise, Idaho. He replaces **J. W. Buckingham,** who also resigned as general manager. **Walter Y. Yarbrough,** former sales manager, has taken over the latter post.

Emmett A. Williams has been appointed vice president in charge of operations and **I .E. Cox** as vice president in charge of engineering of the National Bearing Div., American Brake Shoe Co.

W. J. Gleason has been named export sales manager of Kaiser Co., Inc., Iron and Steel Div.

Sixten F. Wollmar, formerly vice president of the Hartford-Empire Co., Hartford, Conn., has been elected president to succeed **F. Goodwin Smith,** who has become chairman of the board.

William P. Huxley has been named sales manager of Hamilton Standard Propellers Div., United Aircraft Corp., East Hartford, Conn.

Donald S. Sammis, works manager of the Underwood Corp., Bridgeport, Conn., has been elected vice president and general manager of the Hartford plant.

Forrest A. Marsh has been appointed assistant to the vice president in charge of sales of the National Tube Co. He succeeds **James B. Graham,** who is retiring.

David E. Lukens has been named general manager of the Philadelphia Tube Co., Philadelphia, Pa.

Gerald I. Carlson has been named director of engineering of the Stratos Corp., Babylon, N. Y.

Al Seedorff has been named exclusive sales representative for the Progressive Welder Co. in the state of California. His headquarters are at 10990 Wilshire Blvd., Los Angeles.

H. Webster Crum has been named sales manager of the Goodyear Aircraft Corp., succeeding **T. A. Knowles,** who has become vice president and general manager.

Lester J. Henderson has been appointed general sales manager of the Aeroquip Corp., Jackson, Mich. He was formerly assistant general sales manager of the Weatherhead Co., Cleveland.

H. J. Fraser and **H. J. French** have been elected additional vice presidents of The International Nickel Co., Inc. Both men are assistant vice presidents of The International Nickel Co. of Canada, Ltd.

George W. Schweinhard, vice president and general manager of Bethlehem Supply Co. of California, has retired. He has been succeeded by **Wendell M. Jones,** who has been with the company for over 20 years.

Robert C. Schenck, executive vice president for several years, has been elected president of the Durion Co., Inc., Dayton, Ohio. He succeeds **William E. Hall,** who has been named chairman of the board.

George F. Jenkins has been named assistant sales manager of the National Screw & Manufacturing Co., Cleveland, succeeding **Charles L. Kerr,** who resigned after 23 years to start his own business.

Charles H. Krane has been appointed field engineer of the Norton Co., Worcester, Mass., with headquarters in Hartford, Conn.

Ralph D. Holcomb

J. G. Bollinger

Ralph D. Holcomb has been appointed general sales manager for the Harnischfeger Corp., Milwaukee, Wis. He has been associated with the concern for 18 years, most recently as district manager for the San Francisco area.

J. G. Bollinger has been appointed district sales manager of Air Reduction Sales Co., New York City, in the Pacific Coast Div. He has been with Air Reduction for more than 20 years and will make his headquarters at 1485 Park Ave., Emeryville, Calif.

Dr. George H. Spencer-Strong, director of research since 1942, has been elected a vice president of the Pemco Corp., Baltimore, Md.

Leo A. Carter has been named manager of the Santa Monica plant of Douglas Aircraft Co., Inc., succeeding **G. A. Huggins.**

Benjamin C. Bowker has been named special assistant to the president of Willys-Overland Motors.

Michael P. Walker has been named general sales manager of the Aluminum Solder Corp., New York City.

BUSINESS ITEMS

Sheffield Corp., Dayton, Ohio, has appointed the **Reasoner Tool and Supply Co.**, 144 Pearl St., Boston, Mass., as its gage and instrument representative in eastern Mass., Maine, N. H., and Vt. Stocks of standard items will be maintained in the Boston area to provide quick delivery. **Richard S. Brown,** Wilbraham, Mass., has been appointed Sheffield machine tool representative for the territory.

E. W. Bliss Co., Detroit, has opened an office in the Verhovey Bldg., 436 4th Ave., Pittsburgh, Pa. **Joseph G. Holzschuh** has been appointed sales engineer in the area.

C. L. Kerr Industries, Inc., has been formed by **Charles L. Kerr,** former assistant sales manager of the National Screw & Manufacturing Co., Cleveland. The company will manufacture screw machine products, specializing in short-run quantities.

Davis & Thompson, Milwaukee, Wis., has established a Detroit office, with **Perry D. Gasnier** as manager.

Siewek Tool Div., Domestic Industries, Inc., Chicago, has been acquired by **C. D. Reason** of Detroit. The company will be operated as **Siewek Tool Co.**, with Mr. Reason, who has been eastern sales manager of the division, as president and treasurer and **Daniel R. Reason** as vice president.

Air Reduction Sales Co. has opened a new store and district office at 1485 Park Ave., Emeryville, Calif. **H. W. Saunders,** district manager, is in charge of the store and office.

Autopulse Corp., Detroit, manufacturers of electric fuel pumps, has arranged to have its export activities handled by **Borg-Warner International Corp.**

Leland-Gifford Co., Worcester, Mass., will open a new Los Angeles office in the Corporation Bldg., So. Spring St., April 1. **A. P. Witteman,** who has been in charge of the Cleveland district for the past 11 years, will be in charge of the new office. He is being replaced in Cleveland by **Raymond D. Critzer.**

Wheelco Instruments Co., Chicago, has opened a Philadelphia sales and service office at 424 W. Olney Ave., Philadelphia, of which **E. W. Heffernan** is manager.

Permanente Metals Corp., Aluminum Div.; Kaiser Co., Inc., Iron & Steel Div.; and **Permanente Cement Co.**, have established separate export sales departments. **Bert Inch** heads a general sales office handling Kaiser Aluminum export sales, while **W. J. Gleason,** former head of the centralized export sales department of Kaiser activities, is in charge of Kaiser Steel export sales, and **Frank Potts** is directing Permanente Cement sales. Headquarters for all three are in Oakland, Calif.

American Gear & Mfg. Co. has been organized and is located at 5900 Ogden Ave., Chicago. **Warren J. Kilburn** is president; **Maurice P. Collins,** vice president in charge of manufacturing; **John J. Fajnor,** vice president in charge of sales and advertising; and **Alan B. Gilbert,** vice president in charge of engineering.

Rollins Machinery, Ltd., has been incorporated and is located at 404 Rogers Bldg., 470 Granville St., Vancouver, B. C.

OBITUARIES

E. C. Gyllensvard

Eric C. Gyllensvard, export and New York office manager of Farrel-Birmingham Co., Inc., Ansonia, Conn., was killed Feb. 17 when struck by lightning in Sao Paulo, Brazil, while on a business trip to South America. He joined the firm in 1944 and for seven years previously, he was export manager of the Sullivan Machine Co. In 1942 and 1943 he served as president of the Machinery & Metals Export Association.

Louis B. Patterson, one of the founders of The Avey Drilling Machine Co., Cincinnati, died Feb. 25. He was president and treasurer of the firm from its inception in 1907 until a month before his death and was well known in the industry.

Frank Cooper, 92, director of Buck & Hickman, London, England, until his retirement, died Feb. 24. He was well and favorably known to machine tool builders in this country which he visited frequently before his retirement.

John H. Allen, 89, founder and president of Everlasting Valve Co., Jersey City, N. J., passed away Feb. 18. Before becoming president of the firm, he served as general manager.

John A. Markley, 86, founder and president of the Lake Erie Forge & Machine Co., Cleveland, died March 3.

John H. Walters, 62, president of the Marlin-Rockwell Corp., Jamestown, N. Y., passed away Feb. 21. He was named president of the firm in 1946, having served as vice president and treasurer for many years.

Henry L. Randall, president of the Riverside Metal Co., Riverside, N. J., died Feb. 18. He joined American Brass Co. in 1916 and became president of Riverside in 1920.

Alexander W. Pound, 57, former purchasing agent of the Harrison Radiator Div., General Motors Corp., died suddenly Feb. 24.

William Johnston, 56, president of the Johnston Machinery Co., Cincinnati, passed away Feb. 24.

MEETINGS

American Iron & Steel Institute. General meeting. Hotel Pierre, May 21. Waldorf-Astoria Hotel, May 22. New York, N. Y. George S. Rose, Secretary, 350 Fifth Ave., New York, N. Y.

American Management Association. Production meeting. Hotel Pennsylvania, New York, N. Y. April 14-15. Edward K. Moss, director of Public Relations, 330 W. 42 St., New York 18, N. Y.

Metal Powder Association. Annual spring meeting. Waldorf-Astoria Hotel. New York, N. Y. May 27. Association Headquarters, 420 Lexington Ave., New York, N. Y.

Society of Automotive Engineers. Spring Aeronautic meeting. Hotel New Yorker, New York, N. Y. April 9-11. Transportation meeting. Hotel Stevens, Chicago, Ill. April 16-18. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

Society of the Plastics Industry, Inc., National Plastics Exposition. The Coliseum. Chicago, Ill. May 6-10. Wesley S. Thurston, director of public relations, 330 W. 42 St., New New York, N. Y.

Southern Machinery & Metals Exposition. 2nd annual exposition. Municipal Auditorium, Atlanta, Ga. April 14-17. R. S. Lynch, president, Atlantic Steel Co., Atlanta, Ga.

IT'S TIME TO TURN TO . . .

Threadwell

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TAPS . . . FOR ALL PRODUCTION TAPPING OF CAST IRON, STEELS, ALLOYS AND PLASTICS

Threadwell Screw Plates with round dies equipped with individual pressed steel guides that assure perfectly straight threads. Stock has triple adjustment for cutting standard, oversize or undersize threads as desired. Write for Bulletin.

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Threadwell COLD-TEMPER Taps are *deep-freeze* treated at 120° below zero. The result — more and better threads per tap. They're ideal for tapping abrasive materials.

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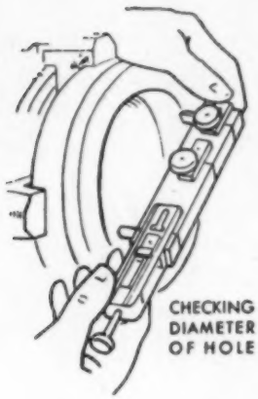
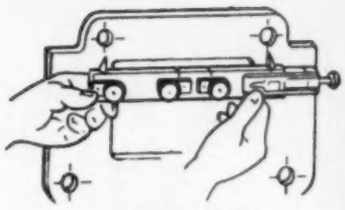
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



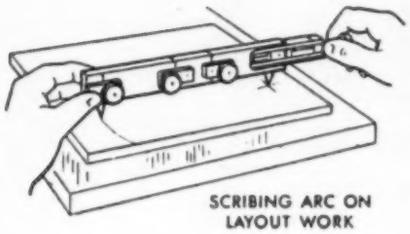
CHECKING DIAMETER OF HOLE



CHECKING HOLE LOCATIONS

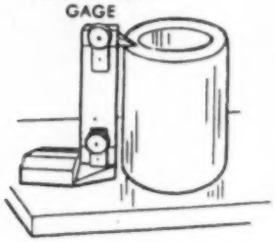
WEBBER HEAVY DUTY

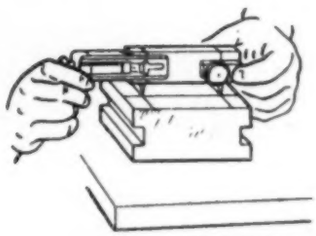
GAGE BLOCKS and FIXTURES



SCRIBING ARC ON LAYOUT WORK

USING HEIGHT GAGE





CHECKING PRECISION LAYOUT

TIME SAVING PRECISION

- √ DIVIDER
- √ HEIGHT GAGE
- √ SCRIBER
- √ SNAP GAGE

Production is never held up for lack of special purpose gages when Webber Heavy Duty Gage Blocks are in the shop. They can easily be adapted as a master or production gage for almost any tool or machining operation. They eliminate the immediate need for special plug or height gages. They are assembled and put to work within a few minutes. The patented clamps, gage blocks and holding fixture are built for rugged service plus gage block accuracy. *Bulletin on request.*

WEBBER GAGE CO., 12901 Triskett Rd., Cleveland 11, Ohio

WEBBER MAKES PRECISION GAGE BLOCKS EXCLUSIVELY

- ★ Gage Block Sets in Steps of .00005".
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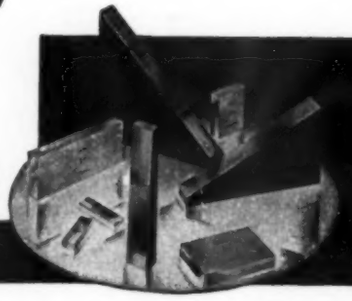
- ★ Carblox (Carbide) Wear Gages.



Webber
PRECISION
GAGE BLOCKS

Rules for Drawing Round Shells—I

COURTESY DAYTON ROGERS MANUFACTURING COMPANY

IN metal-stamping work, the expression "drawing" describes an operation in which a flat sheet or metal blank is formed into a shell or cup of fairly uniform thickness. In producing round shells without flange, the factors that govern the possible height of single-operation drawing of a shell are:

1. Ratio of height to diameter of shell
2. Ductility of the material
3. Corner radius

When drawing a round shell (without flange) in one operation, the maximum ratio of height divided by diameter may vary between ¼ and a possible ¾, depending on the corner radius and ductility of the material. A generous corner radius helps to secure greater height in one operation, while too small a corner radius may cause the shell to fracture at the radius. Soft, ductile material will permit drawing to a greater height in one operation.

Ductility of materials is measured as percent elongation in 2 in. or percent reduction of area. In general, materials such as deep-drawing steel, annealed sheet steel (SAE 1005 - 1015), dead-soft cold - rolled strip steel (SAE 1010-1020), some stainless steels (304, 410, 420 and 430), soft-temper aluminum (2SO, 3SO and 53SO), soft-temper brass and copper will allow drawing to a maximum height in one operation. Other less ductile materials may require one or more pre-cupping operations; that is, additional drawing dies for gradually reducing the blank to the diameter required, and possibly annealing between operations.

Corner radius of the shell has a considerable effect on the possible height of single-operation drawing. Corner radius should, when possible, be specified at a minimum of four times thickness of material when the height of the shell exceeds one-third of the diameter. When a smaller radius is specified, additional drawing or flattening operations may be

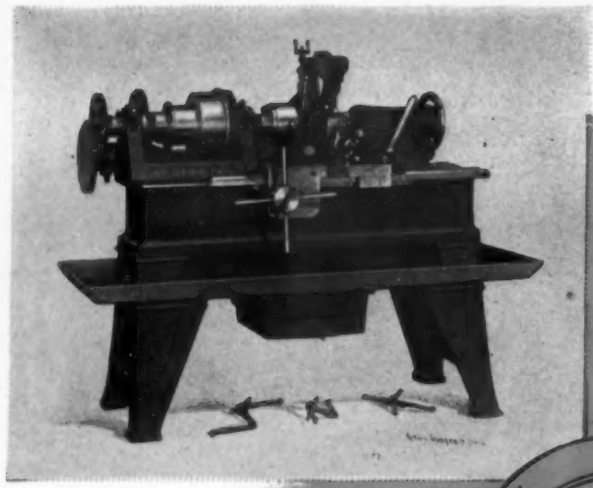
Draw-Reduction Ratios for Round Shells

(Without Flange)

Shell height = inside height of shell
Shell diameter = inside diameter of shell plus one thickness of material

Height-Dia. Ratio	% Reduction of Dia.	Blank-Draw Ratio	Height-Dia. Ratio	% Reduction of Dia.	Blank-Draw Ratio	Height-Dia. Ratio	% Reduction of Dia.	Blank-Draw Ratio
.01	2.0	1.02	.48	41.5	1.70	.95	54.4	2.194
.02	3.8	1.03	.49	41.9	1.72	.96	54.5	2.201
.03	5.5	1.05	.50	42.3	1.73	.97	54.7	2.208
.04	7.1	1.07	.51	42.7	1.745	.98	54.9	2.216
.05	8.7	1.09	.52	43.1	1.758	.99	55.1	2.224
.06	10.2	1.11	.53	43.5	1.770	1.00	55.3	2.231
.07	11.5	1.13	.54	43.8	1.780	1.05	56.2	2.28
.08	13.0	1.15	.55	44.2	1.790	1.10	57.0	2.32
.09	14.3	1.16	.56	44.5	1.800	1.15	57.8	2.37
.10	15.4	1.18	.57	44.8	1.810	1.20	58.5	2.41
.11	16.6	1.20	.58	45.1	1.820	1.25	59.2	2.45
.12	17.8	1.21	.59	45.4	1.830	1.30	59.9	2.49
.13	18.8	1.23	.60	45.8	1.840	1.35	60.5	2.53
.14	19.9	1.24	.61	46.0	1.850	1.40	61.0	2.56
.15	21.0	1.26	.62	46.4	1.862	1.45	61.6	2.60
.16	21.9	1.28	.63	46.7	1.873	1.50	62.2	2.64
.17	22.8	1.29	.64	47.0	1.885	1.55	62.7	2.68
.18	23.7	1.31	.65	47.3	1.898	1.60	63.2	2.72
.19	24.6	1.32	.66	47.6	1.910	1.65	63.7	2.76
.20	25.5	1.34	.67	47.8	1.920	1.70	64.2	2.79
.21	26.3	1.35	.68	48.1	1.930	1.75	64.6	2.83
.22	27.1	1.37	.69	48.4	1.940	1.80	65.1	2.86
.23	27.8	1.38	.70	48.7	1.950	1.85	65.5	2.90
.24	28.6	1.40	.71	49.0	1.960	1.90	65.9	2.93
.25	29.3	1.41	.72	49.2	1.970	1.95	66.3	2.97
.26	30.0	1.43	.73	49.5	1.980	2.00	66.7	3.00
.27	30.7	1.44	.74	49.8	1.990	2.05	67.0	3.03
.28	31.3	1.45	.75	50.0	2.000	2.10	67.4	3.06
.29	31.9	1.47	.76	50.2	2.010	2.15	67.8	3.10
.30	32.6	1.48	.77	50.5	2.020	2.20	68.1	3.13
.31	33.2	1.49	.78	50.7	2.030	2.25	68.4	3.16
.32	33.8	1.51	.79	51.0	2.040	2.30	68.7	3.20
.33	34.4	1.52	.80	51.2	2.050	2.35	69.0	3.23
.34	35.0	1.53	.81	51.4	2.060	2.40	69.3	3.26
.35	35.5	1.55	.82	51.6	2.070	2.45	69.6	3.29
.36	36.0	1.56	.83	51.8	2.080	2.50	69.9	3.32
.37	36.5	1.57	.84	52.1	2.090	2.55	70.2	3.35
.38	37.0	1.58	.85	52.4	2.100	2.60	70.4	3.38
.39	37.5	1.60	.86	52.6	2.110	2.65	70.7	3.41
.40	38.0	1.61	.87	52.8	2.120	2.70	70.9	3.44
.41	38.5	1.62	.88	53.0	2.130	2.75	71.2	3.47
.42	39.0	1.63	.89	53.2	2.140	2.80	71.5	3.50
.43	39.4	1.65	.90	53.4	2.150	2.85	71.7	3.53
.44	39.8	1.66	.91	53.6	2.160	2.90	71.9	3.56
.45	40.2	1.67	.92	53.8	2.170	2.95	72.1	3.58
.46	40.7	1.68	.93	54.0	2.178	3.00	72.2	3.60
.47	41.1	1.69	.94	54.2	2.185			

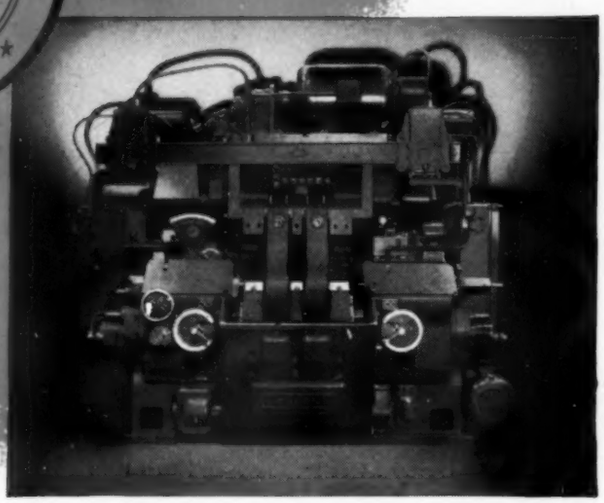
How to use table: Divide height of shell by diameter; find corresponding ratio in col. 1; Percent reduction is given in col. 2 (use to determine number of reductions required); Blank-draw-ratio is given in col. 3 (blank-draw ratio times shell diameter equals blank diameter approximately).



IN 1897 this LeBlond Bicycle Crank Machine was the last word in production machinery. It "chased a right and left hand thread, faced off the spider, and turned 2 sizes and shoulders for cones"—at the rate of 12 per hour. Six feet long, it weighed 2400 lbs.

50 years of Crankshaft Lathe building

IN 1947 LeBlond Automatic Crankshaft Lathes are still the last word in production machinery. Automatic or Universal, there is a LeBlond crankshaft lathe to turn out, at the rate of from 15 to 50 units per hour, multiple throw cranks for small 2 cycle gasoline engines, for 4-, 6-, and 8-cylinder automotive engines, and for huge 2000 HP diesels. These special purpose lathes weigh up to 20 tons ... almost 20 times the weight of the original.



THE FIRST LEBLOND CRANKSHAFT LATHE—the Bicycle Crank Machine—was designed and built by Mr. R. K. LeBlond 10 years after he opened his machine tool plant in 1887. Ahead of the machines of the time, it was the earliest forebear of the huge crankshaft lathes now being produced at LeBlond.

50 YEARS OF LEADERSHIP in crankshaft lathe building is but one more indication of the progressive design and engineering ingenuity built into every LeBlond lathe. Just as there is a special LeBlond lathe for every crankshaft, so, too, there is a lathe in the LeBlond line for every metal turning problem.

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO.
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES
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Write for your pictorial copy of LeBlond's lathe brochure.

LEBLOND

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Rules for Drawing Round Shells—II

required. In no case should the corner radius be less than thickness of material for a one-operation draw.

When the ratio of "height divided by diameter" exceeds ⅝, it will be necessary in most cases to reduce the flat blank to the finished shell by using two or more draw dies of proportionately decreasing diameters. In some cases, one or more annealing operations will be necessary between first and finish draw operations. The necessity of annealing depends to a large extent on the workability of the metal being drawn.

Determination of the number of reductions necessary to draw a shell with ratios (height divided by diameter) greater than ⅝ cannot be done by hard and fast rules. In general, for ductile materials, with generous corner radius in the shell, the requirements are:

1. Height equals ⅝ to 1⅛ times the diameter of the shell—two reductions will be required.
2. Height equals 1⅛ to 2 times the diameter of the shell—three reductions will be required.
3. Height equals 2 to 3 times the diameter of the shell—four reductions will be required.

It may be necessary to anneal the shell when more than two reductions are required. When corner radius is less than four thicknesses of material, add one or two flattening dies and operations, depending on corner radius desired.

For less-ductile materials, it is more difficult to predict the number of operations required. In general, the measure of ductility of the material (percent of elongation or percent reduction of area) will determine the maximum reduction possible in one operation.

Finish of edge depends on the "height divided by diameter" ratio and on the material being drawn. For relatively shallow shells where the "height divided by diameter" ratio is not over 1/3, it is possible to produce an edge within commercial tolerances without requiring finishing operations. That is, the height and uniformity of the edge depends on the size of blank used. For higher shells it is not possible to do this, and one of the following finishing operations will be required:

1. Flange trim and finish draw (Fig. 1).
2. Pinch trim (Fig. 2).
3. Machine trim (Fig. 3).
4. Wedge or "shimmy"-die trim (not suitable for small quantities).

A "Draw Reduction Table" offers a simple means of determining percent of draw reduction and flat-blank diameter. By dividing the inside shell height by the mean shell diameter, a height-diameter ratio is obtained. Find this ratio in Col. I of the table. Directly opposite in Col. II find the percent of reduction of diameter (a measure of the amount of cold-working to be done in drawing the flat blank into a shell). Directly opposite in Col. III, find the Blank-Draw ratio. Multiply the mean shell diameter by this factor to obtain the approximate flat blank diameter.

It must be understood that this table can only be used with round straight-sided shells or cups. Shells or cups with flanges must be investigated by other methods. Care must be used when attempting to predict the number of operations required to produce a flanged shell or cup.

EDGE-TRIMMING METHODS

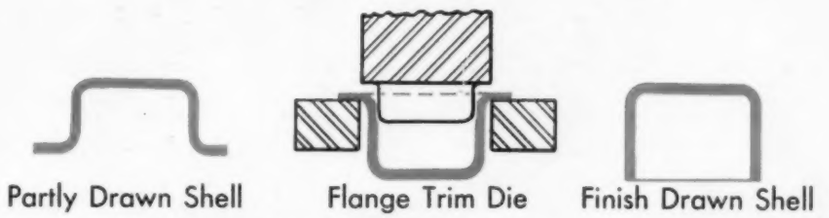


Fig. 1—**FLANGE TRIM AND FINISH DRAW.** This method is satisfactory for most shells, particularly diameters greater than 2 in. Only one additional die—a trimming die—is required.

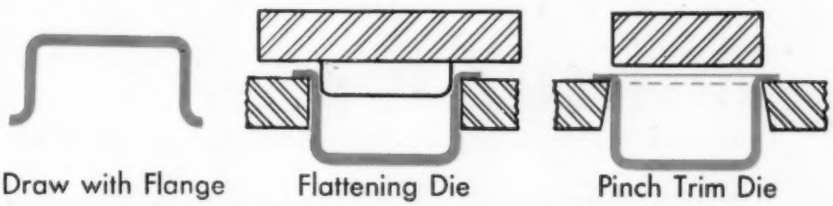
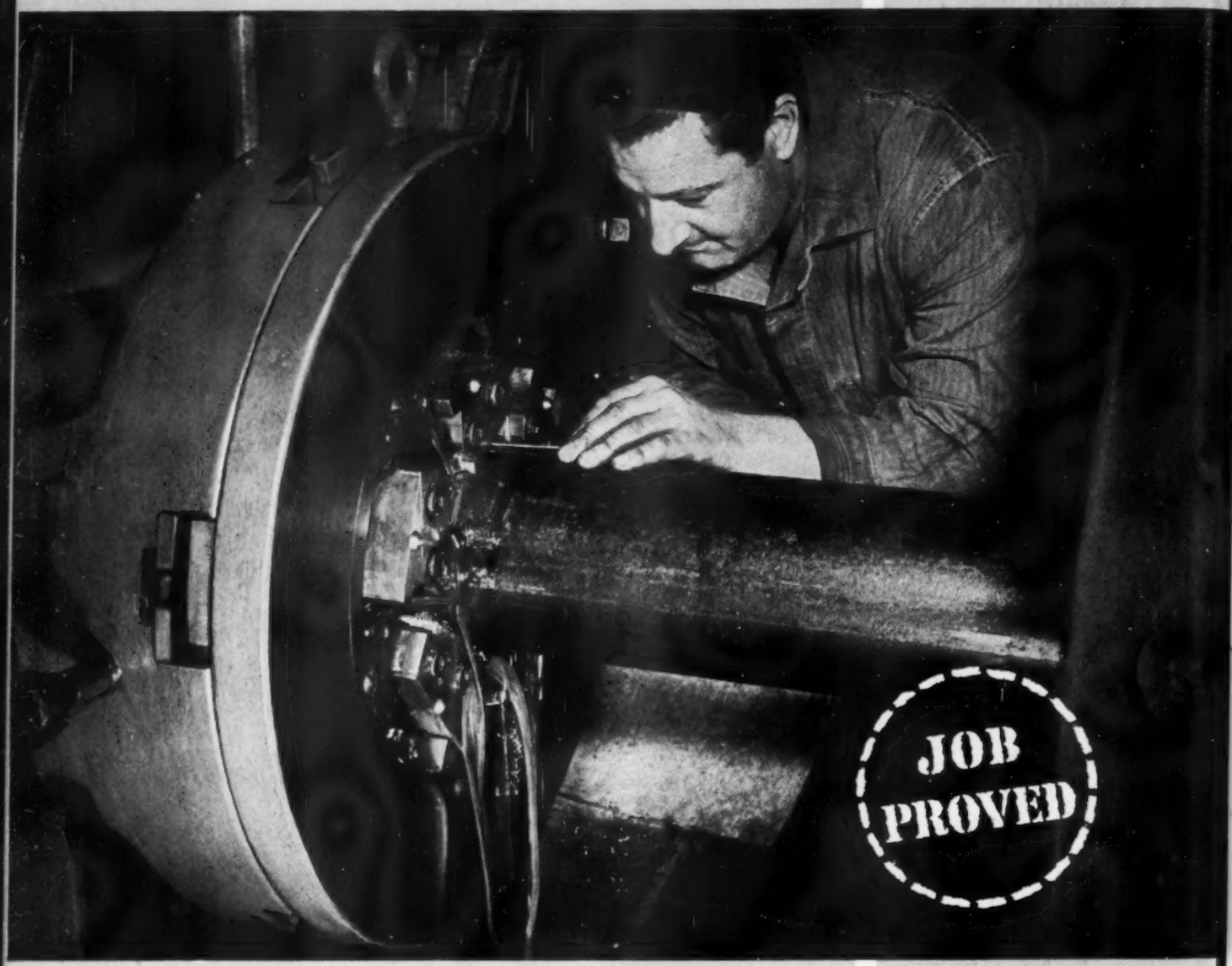


Fig. 2—**PINCH TRIM DIE.** This method will produce a shell with uniform height, but the inside edge is considerably rounded. The flange must be flattened to a sharp corner, which will require one or two dies.

Fig. 3—**MACHINE OR BOX TRIM.** Tooling cost is generally low, but this method is slow. The best-appearing edge is produced, and sometimes this method is the only practical one.

Cutting Better Threads...Faster



SUNICUT 196...

Speeds Up Threading of Automatic Sprinkler Pipes, Improves Quality of Threads

Here is a case where a big manufacturer of automatic fire-sprinkler systems increased production and improved his threads by replacing a special, expensive oil with Sunicut 196.

Machine: No. 5 Landis Pipe-Threading Machine.
Operation: Threading ⅜" to 8" Pipe. **Lubricant:** Sunicut 196.

In this case, a saving of 15% in oil costs resulted. This is a typical example of how Sun's "Job-Proved" cutting oils have aided in speeding up production and in reducing costs.

Machine-tool operators prefer Sunicut because it is a clear, transparent, free-flowing, sulphurized mineral oil. Sunicut is recommended for those exacting jobs where an emulsifiable cutting oil is not suitable.

Other "Job-Proved" Sunicut grades are suitable for use on automatic lathes, gear-cutters, etc. Contact the nearest Sun office for recommendations.

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American Machinist

REFERENCE BOOK SHEET

Thrust Loads in Drilling Various Metals

COURTESY CANEDY-OTTO MFG. COMPANY

Drill Size	Feed in Inches per Revolution: 0.001	0.005	0.010	0.015	0.020	0.001	0.005	0.010	0.015	0.020
	CAST IRON					MACHINE STEEL				
1/16	20	74	128	177	223	42	128	207	274	335
3/32	27	98	170	235	296	55	170	275	364	445
1/8	33	120	208	288	362	68	207	336	445	544
5/32	44	159	276	382	481	90	275	446	591	723
1/4	54	194	338	467	588	110	337	546	723	884
5/16	63	227	395	546	688	128	394	638	846	1035
3/8	71	258	449	621	781	146	447	725	961	1175
7/16	79	287	500	692	871	163	498	807	1070	1310
1/2	87	315	549	759	956	179	547	886	1175	1435
9/16	95	342	596	825	1040	194	594	962	1275	1560
5/8	102	369	642	888	1115	209	640	1035	1375	1680
11/16	109	394	686	949	1195	223	684	1105	1470	1795
3/4	116	419	729	1010	1270	237	727	1175	1560	1905
13/16	122	443	771	1065	1340	251	768	1245	1650	2015
7/8	129	467	812	1125	1415	264	809	1310	1740	2125
15/16	135	490	852	1180	1485	277	849	1375	1825	2230
1	141	512	892	1235	1550	290	889	1440	1910	2330
1 1/8	154	556	968	1340	1685	315	965	1565	2075	2535
1 1/4	165	599	1040	1440	1815	339	1040	1685	2230	2725
1 3/8	178	640	1115	1540	1940	362	1110	1800	2385	2915
1 1/2	188	680	1185	1640	2060	385	1180	1910	2535	3100
1 5/8	199	720	1255	1730	2180	407	1250	2020	2680	3275
1 3/4	209	758	1320	1825	2295	429	1315	2130	2825	3450
1 7/8	220	795	1385	1915	2410	450	1380	2235	2965	3620
2	230	832	1450	2005	2520	471	1445	2340	3100	3790
2 1/4	249	904	1575	2175	2740	511	1570	2540	3370	4115
2 1/2	268	973	1695	2340	2950	551	1690	2735	3625	4430
2 3/4	287	1040	1810	2505	3150	589	1805	2925	3875	4735
3	305	1105	1925	2660	3350	626	1915	3105	4120	5030
3 1/2	340	1230	2145	2965	3730	697	2135	3460	4590	5605
	CAST STEEL					CARBON STEEL				
1/16	29	96	161	219	271	50	146	233	306	371
3/32	38	127	214	291	360	66	195	310	406	492
1/8	47	156	262	356	440	81	238	379	497	602
5/32	62	207	348	472	585	108	316	503	660	800
1/4	76	253	425	578	715	132	387	615	807	978
5/16	88	296	497	675	836	154	452	719	943	1145
3/8	101	336	565	767	950	175	513	817	1070	1300
7/16	112	374	629	855	1060	195	572	910	1195	1445
1/2	123	411	691	938	1160	214	628	999	1310	1590
9/16	134	446	750	1020	1260	232	682	1085	1425	1725
5/8	144	480	808	1095	1360	250	734	1170	1530	1860
11/16	154	514	864	1170	1450	267	785	1250	1640	1985
3/4	163	546	918	1245	1545	284	834	1325	1740	2110
13/16	173	577	971	1320	1630	300	882	1405	1840	2230
7/8	182	608	1020	1390	1720	316	929	1475	1940	2350
15/16	191	668	1075	1455	1805	332	975	1550	2035	2470
1	200	698	1125	1525	1890	347	1020	1620	2130	2580
1 1/8	217	725	1220	1655	2050	377	1110	1760	2310	2805
1 1/4	233	780	1310	1780	2205	406	1175	1895	2490	3020
1 3/8	250	834	1400	1905	2360	434	1190	2030	2660	3225
1 1/2	265	887	1490	2025	2510	461	1355	2155	2830	3430
1 5/8	280	938	1575	2140	2650	487	1435	2280	2990	3625
1 3/4	295	988	1660	2255	2795	513	1510	2400	3150	3820

At the sound of the musical note

When you tap this grinding wheel, a clear answering note tells you that it is free from cracks, just as the Simonds Abrasive label tells you that it is ready for top performance on the job. This performance efficiency is characteristic of all Simonds Abrasive Wheels . . . a precision manufactured line of the most minute variations of grain, grade, structure and bond, skillfully engineered into thousands of abrasive combinations for every industrial use. Careful handling will prolong the efficiency of these performance proven wheels. The tap test is a quick way of determining whether essential wheel care is being maintained.

The Simonds Abrasive Data Book contains information you need for better grinding results. Send for your copy today. For assistance in requisitioning consult your nearest Simonds Abrasive Distributor.

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Shop Equipment News

Hardinge Brothers Chucking Machine Turns, Bores, Threads 6-in. Parts

A multi-operation chucking machine has been developed by Hardinge Brothers, Inc., Elmira, N. Y. An entirely new machine, it is designed to fill the gap between the Hardinge second-operation machine, which takes care of relatively small work, and large turret lathes.

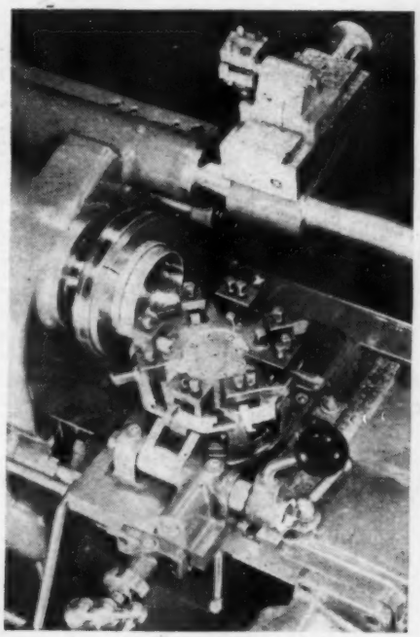
The machine will turn, bore or thread parts up to 6-in. dia. such as finished stampings, castings, forgings, parts which have been blanked out on automatic screw machines or turret lathes, and other parts that normally require many individual setups. Parts that need many bored diameters, turned diameters and threads concentric with each other can be produced on a rapid production basis.

High spindle speed, preloaded-ball-bearing spindle construction, the eight-position cross-feed turret and the production threading head allow close tolerance work to be done in one chucking operation.

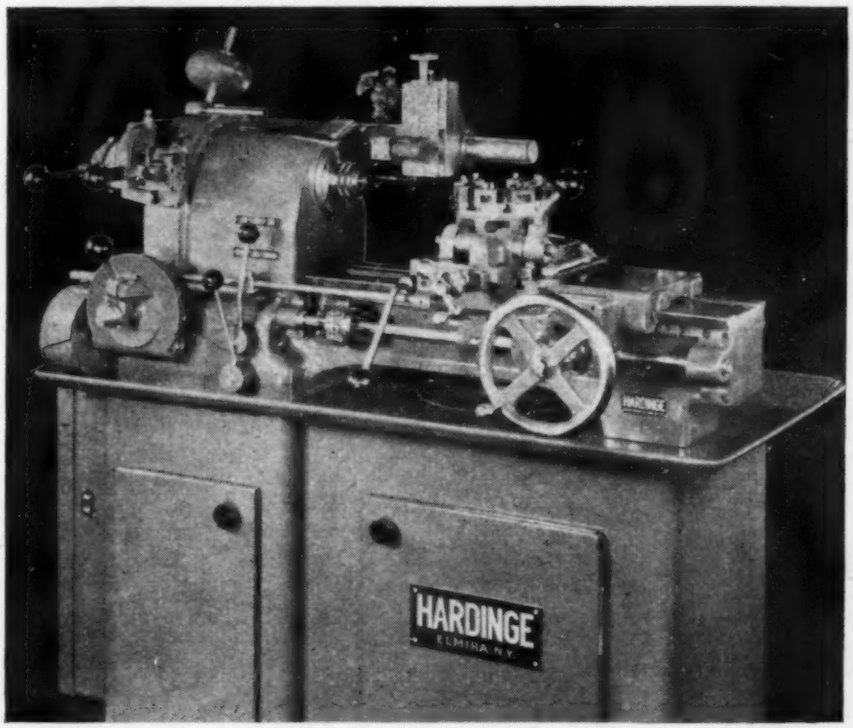
The headstock spindle has a speed range of 150 to 3,000 rpm., forward or reverse. It takes standard 5C collets, providing 1-in. round collet-capacity. Step chucks provide collet-like chucking of work up to 6-in. dia. Using 2-, 3-, or 4-jaw chucks permits odd-shaped parts to be held.

The turret has eight stations, each of which can be adjusted without affecting the others. This eliminates hammering tools for final adjustment. Standard ⅜-in. square toolbits or ⅜x¾-in. rectangular tools are taken directly on the hardened, ground-steel top surface. By taking single, double or triple toolholders, as many as 24 single-point operations can be performed with one set up.

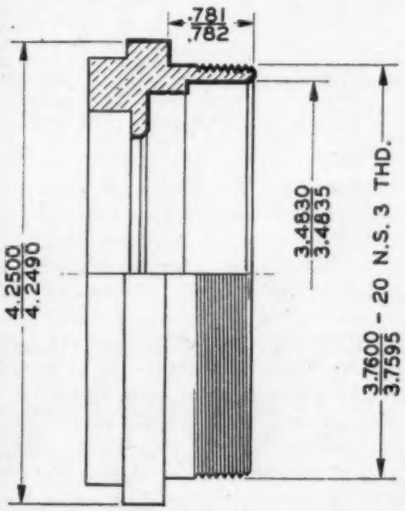
The turret is crossfed by either screw or lever. Work can be faced, turned and bored at extremely short-



Turret works up close to the part which is held in a standard step chuck



High-speed threading is done by a separate unit mounted in the rear of the headstock of this multi-operation chucking machine



Typical part requires the machining of 12 surfaces and threading operation

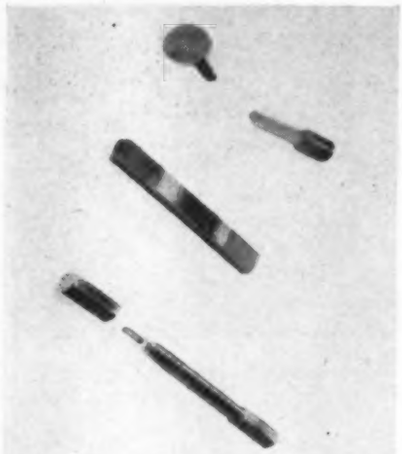
length tooling, because the face can be brought right up to the work.

The precision threading unit is separate, making it equivalent to a ninth station. The threading head is controlled by a master lead screw mounted directly in the rear of the headstock spindle. Threading is done at speeds usually associated only with turning operations, and can be done up to one-half turn from the shoulder. The thread-length control automatically lifts the tool at the end of the cut, eliminating the need for a thread-relief cut.

The bed has the same dovetail-ways design used on Hardinge lathes and second-operation machines. The carriage is built to be "sensitive" to give the operator the necessary "feel" for precision work.

The machine has a motor compartment in the left-hand side and a tool storage compartment on the right. A coolant pump in the base is individually motorized.

Elgin Sapphire-Tipped Tools For Honing and Burnishing

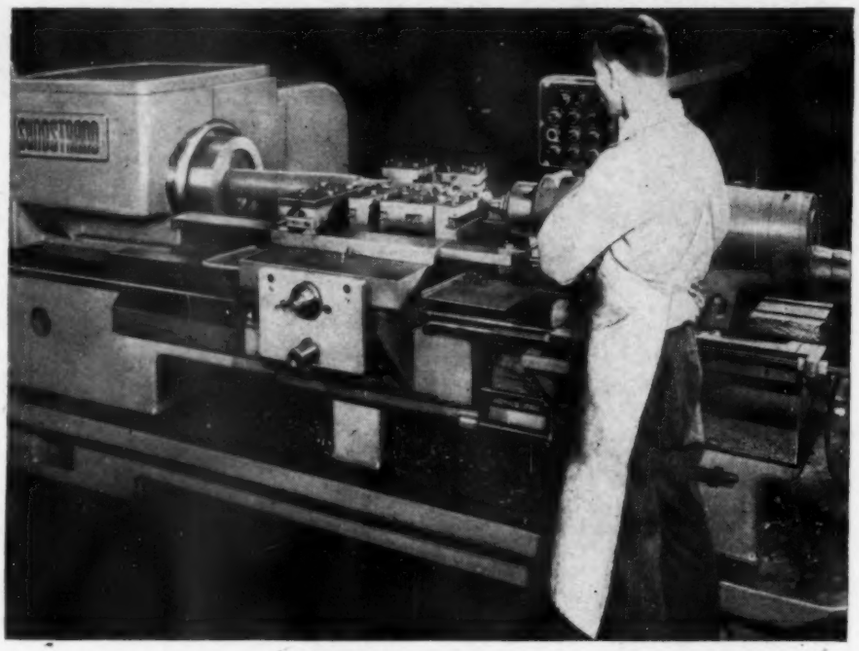


Four sapphire-tipped honing and burnishing tools are announced by Sapphire Products Div., Elgin National Watch Co., Elgin, Ill.

Two of the tools are designed for use on lathe or drillpress for burnishing operations. The one at upper right is for sizing bearings, and the one at upper left is for applying high finishes to outside surfaces and counterbores. They are from 0.200- to 0.700-in. dia. Both are water-cooled, one-end tools.

The other tools are for hand burnishing and have double ends. The bottom one has solid sapphire members protruding, and a round aluminum barrel with caps to protect the ends. The other tool is used for larger or heavier work.

Sundstrand Model 16 Automatic Lathe Provided with 75-hp. Spindle Drive



Pendant control for ease of operation in turning large work is provided on this automatic lathe

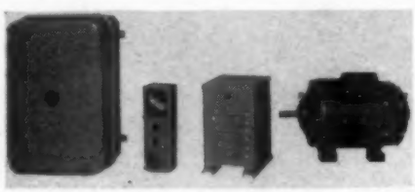
The Model 16 automatic lathe has been added to the line of Sundstrand Machine Tool Co., Rockford, Ill. Larger than the present line, it embodies most of the basic design features.

Three bed lengths are available: 36, 60 and 84 in. between centers. The lathe has a 17-in. swing over slides and will take a 21-in. dia. chuck. Quick cycle changeover and a 75-hp. motor make it possible to multiple-tool the lathe for short runs as well as production turning.

Both the spindle and front-carriage drive units have two different driving-gear centers which give increased range of high and low spindle speeds and carriage feeds. Complete cycle control is provided by adjustment of dogs on a cycle control disk, eliminating the need to make cams. The entire cycle is controlled by pushbuttons.

The tailstock is power operated to aid in loading heavy work pieces. Automatic de-clutching between the spindle and spindle motor with a self-adjusting magnetic brake is provided. The rear carriage is adjustable full length between the headstock and tailstock centers. Screw feed is provided for the front carriage, while adjustment for the rear carriage and tailstock is by rack and pinion.

Raytheon Variable-Speed Drive Gives Speeds Up to 100:1 Ratio



The Servotron electronic variable-speed drive has been developed by Industrial Electronics Div., Raytheon Mfg. Co., Waltham, Mass.

A ¾- to 1-hp. drive, the Servotron consists of four units. They are, starting from the left of the illustration: a control unit consisting of an electronic rectifier and control and protective circuits; a control station with forward, reverse and stop pushbuttons and a speed-setting knob; a transformer to be connected to ac. supply; and a dc. motor.

Speed range is up to 100:1 ratio, and there is nearly flat speed regulation from no load to full load. There are few adjustments to be made in the circuits, and it is said that there is no mechanical shock or electrical line upheaval.

LODGE & SHIPLEY LATHES *at work*

NEW 20" LATHE Doing 7 Operations on precision shafts

ORDER NO.	DEPT. OR MACH.	OPERATIONS
7	MILLING	END MILL SLOT IN END
8	VISE	BREAK CORNERS ON KEYWAYS TO PREVENT CHIPPING DURING STRAIGHTENING
9	HEAT TR.	CARBURIZE
10	LATHE	TURN, FACE, DRILL, TAP, CHASE AND RECENTER
11	LATHE	LATHE-TURN AND FACE OTHER END

● **A graphic demonstration of the versatility of Lodge & Shipley Lathes is this shaft production job in the plant of a noted machine tool builder. The forged shaft is rough turned, heat treated and finally finish turned on the 20" Lodge & Shipley Lathe shown.**

Lathe operations include: Turn, face, drill, tap, chase and recenter . . . performed in minimum times, utilizing a wide range of feeds and speeds.

Reports from owners prove that the new series of 18 and 20 inch Lodge & Shipley Lathes are outstanding in every detail . . . on every machining operation. New from pulley to tailstock, they offer many important advantages over older lathes...often replace several worn and weary tools.

Lodge & Shipley Engineers will gladly demonstrate, with actual production and cost figures, just how much these new lathes can save you. Write on your company letterhead for Bulletins Nos. 503 and 606.

THE WORLD OVER KNOWN FOR GOOD LATHES ONLY L&S LATHES

THE **Lodge & Shipley** COMPANY

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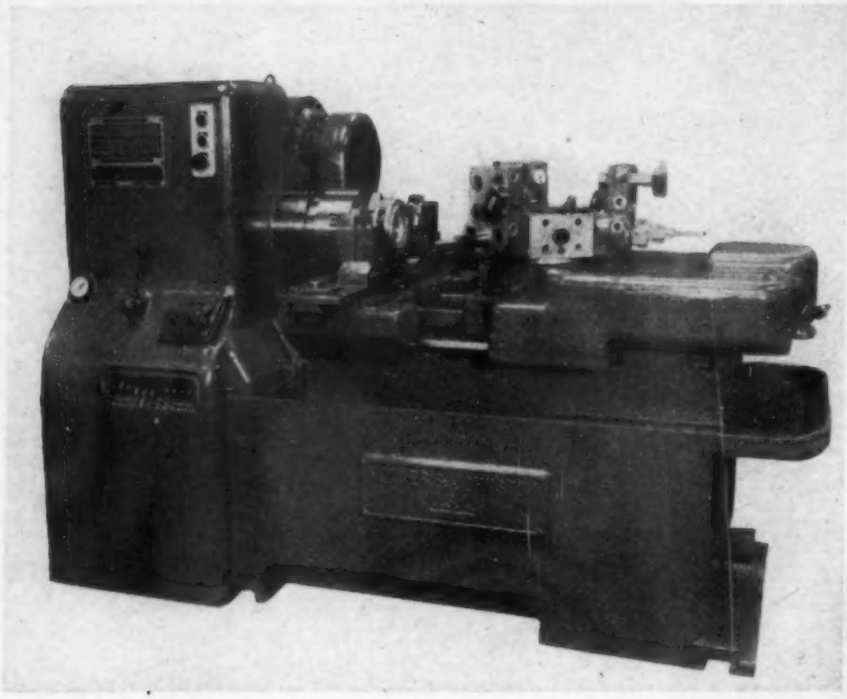
Potter & Johnston 3U Turret Lathe Automatically Machines 6-in. Parts



A cam-actuated plunger on the turret slide permits use of vertical or horizontal slide tools on the turret faces of this small automatic turret lathe

The model 3U automatic turret lathe has been developed by Potter & Johnston Machine Co., Pawtucket, R. I. The smallest of the P. & J. line, the 3U weighs about 5,000 lb. and is designed to machine castings and forgings up to 6-in. dia. and approximately 4 in. long.

The spindle, which is mounted on anti-friction bearings, is adjustable in the headstock up to 3 in. from the various turret faces. Standard speed range of the spindle is 73 to 1445 rpm. Turret-slide and crossfeed speeds range from 0.0023 to 0.0684 in. or from 0.0042 to 0.125 in. per spindle revolution. Machines are available with dual ranges of 36 to 711 rpm. or 72 to 1420 rpm.

There are four automatic changes of spindle speed with each setting of the hand pick-off gears, and three automatic changes of feed. There is an automatic stop at completion of work.

All speed and feed changes are accomplished by means of multiple-disc clutches. To automatically engage or disengage a selected clutch, a dog is applied to the control drum to energize the magnet of a solenoid valve. The valve opens and admits air to the proper air cylinder, thereby actuating the clutch. Close setting of the dogs reduces the non-cutting cycle of the machine to a minimum, and change from rapid traverse to feed, or vice versa, is 1/5 sec. The turret slide can drop from rapid traverse into ¼-in. travel and back again in two seconds using top speed and 0.010 feed.

The turret, which is a "Hollow" type, has six faces on the standard model. Independent cross slides which can operate independently or in conjunction with selected turret faces (or with all turret faces) are mounted on a base set on the bed ways.

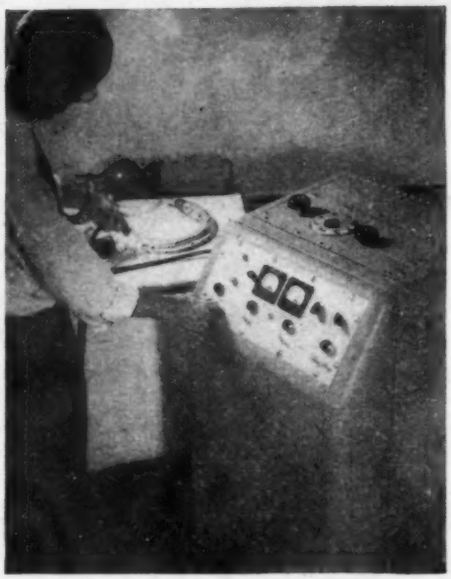
Interlocking and compensating feed clutch members provide safeguards against conflicting clutch action in case of improper set-up. Movement of the turret slides and cross slides, except for cutting, is 24 sec. per cycle.

A combination locking and binding wedge aligns the turret with the spindle. Indexing is by means of Geneva Motion, and the turret is automatically clamped in position. The turret slide is actuated by a face cam, and a cam-actuated plunger operates the vertical- and horizontal-slide tools on the turret faces.

The insulated gear box provides cascade oiling for bearings and gears. The turret-slide parts and bed ways are automatically pressure lubricated by a Bijur system. The box-form base makes liberal provision for coolant supply and chip removal. A motor-driven coolant pump and piping system, and also provision for conveying cutting lubricants through the turret to the work, can be obtained when specified.

There are safety cut-out of motors when cranking for set-up and a safety cut-out switch in case of air failure. Toolholders are aluminum, and an 8-in. air chuck and air cylinder are standard. Provision is made for the application of overhead piloting when specified. Taper boring and turning attachments are available.

Consolidated Leak Detector Has Six Sensitivity Ranges



A portable leak detector that locates and measures leaks in vacuum and pressure systems is made by Consolidated Engineering Corp., Pasadena, Calif.

Said to have accuracy of 0.00000001 cc. per sec., the instrument operates on the mass spectrometer principle. It electronically separates and measures helium molecules, by reason of their mass, from dissimilar molecules in the atmosphere. By introducing helium in a suspected area, leak indication is given on a visual meter or on an audio alarm system. Six sensitivity ranges give a large range of leakage rate, and the pitch of the audio warning signal is in proportion to the leak size.

The detector is 43 in. high, 25 in. deep and 22 in. wide.

Monarch's Speedi-Matic gives you

up to 10 preselected speeds—automatically

● Automatic electronic speed change—repeated piece after piece without attention on the part of the operator!

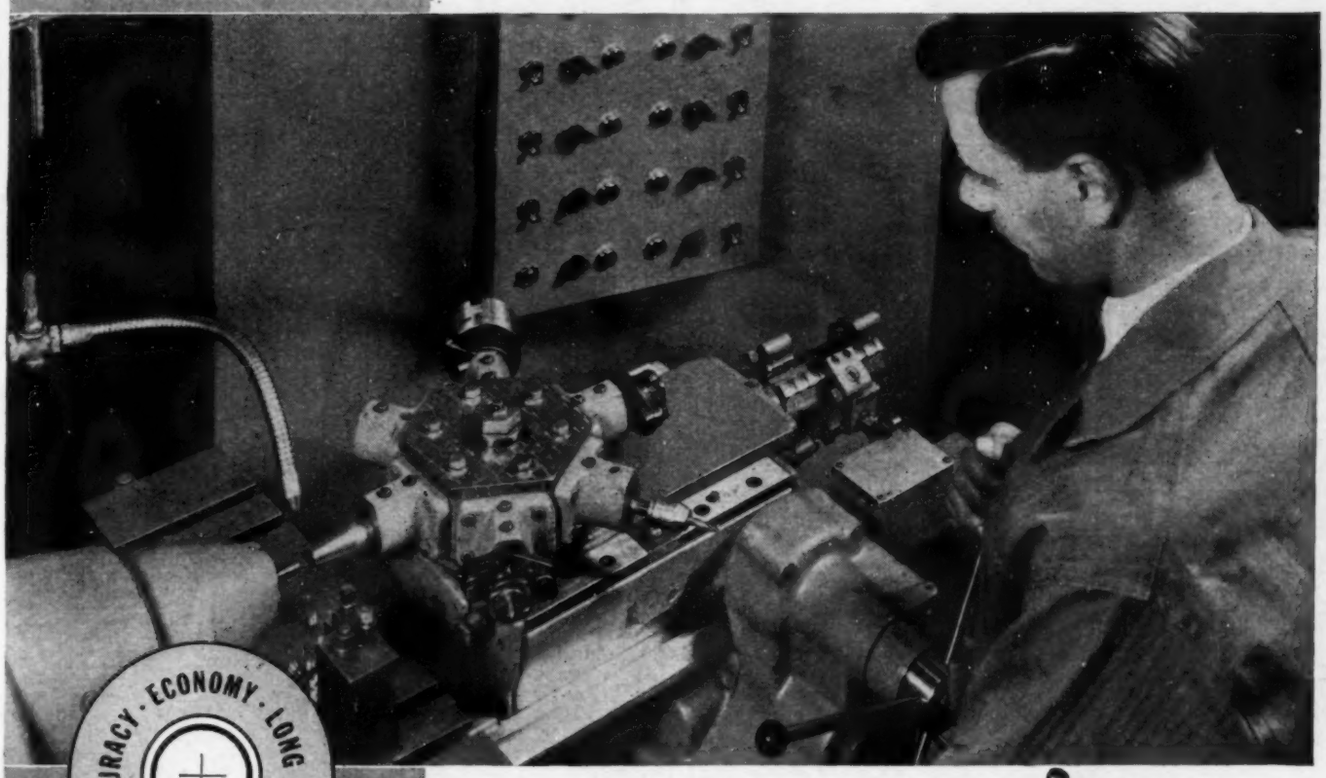
That's *one* of the reasons why the Monarch Speedi-Matic is winning the reputation of the "World's Fastest Hand Screw Machine"—and justifiably so: finished-parts production times are really *production* times, hardly more than the total of the actual times required for the separate cuts—each made *at the optimum surface cutting speed for that particular operation.* (And spindle speeds range up to 5,000 rpm!)

Take the part shown, for example—five different spindle speeds, from a low of 250 rpm to a high of 3,800 rpm—yet the *total* time, including five separate machining operations, is only .43 minutes. Match that record on your present machine, if you can—then send for complete information on the Speedi-Matic!

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

THE PART—spring cap, $\frac{3}{8}$" diam., $\frac{5}{16}$" long; x 1315 steel.

THE PRODUCTION FACTS—Center drill at 3,800 rpm; $\frac{9}{32}$" drill at 3,300 rpm; Flat bottom drill at 3,500 rpm; Thread at 250 rpm; Cutoff at 2,500 rpm. Total time—.43 minutes.



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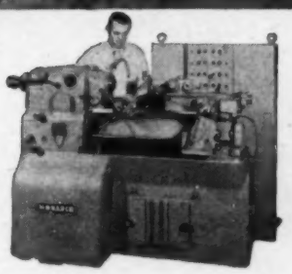
Monarch TURNING MACHINES

For "peak production at a profit" —on bar work up to $\frac{1}{8}$" diameter, in lots of 25 to 500 or more—write for our new 20-page catalog on the Monarch Speedi-Matic.



Brown & Sharpe Surface Grinder Drives Directly or Through Belt

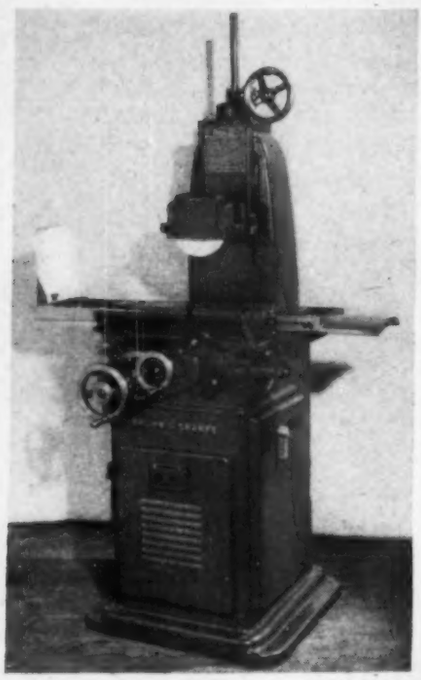


Table travel of 19 or 31 fpm. is selected by a clutch lever at the front of this Brown & Sharpe surface grinder

A redesigned No. 2 surface-grinding machine has been announced by Brown & Sharpe Mfg. Co., Providence 1, R. I. A heavier machine with a larger column for increased rigidity, the No. 2 has a weighted idler pulley in the base to maintain correct belt tension. Conveniently placed controls and improved guarding afford fast and accurate manipulation.

The machine is available with a 1½-hp. motor mounted in the base or with a 1-hp. motor driving the spindle directly. When the motor is in the base, an endless belt within the column provides drive to table and spindle. On the motorized-spindle type the drive is through a vibration-dampening coupling. The latter type has a ¼-hp. motor in the base for table power feed.

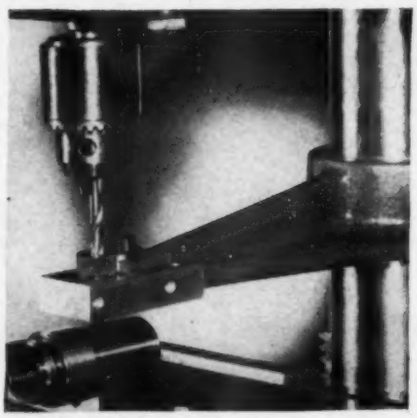
Electrical controls are housed in a separate compartment. The safety handle is interlocked with a disconnect switch.

Two interchangeable cartridge-type spindles are available. One is a plain-bearing spindle and the other is a permanently sealed grease-lubricated antifriction-bearing spindle. Selection of either spindle depends upon shop conditions or individual preference.

Also available is the No. 2B model which has hand feeds only. It has the same spindle choice as on the No. 2 machine.

Both machines grind work up to 18 in. long, 6 in. wide and 9½ in. high. A 7-in. dia. wheel is used.

Aetna's Adapter for Drillpresses Supplies Bushing Support to Drill



The Aetna Adapter, an aluminum alloy casting to be attached to the column of small popular-make drillpresses, has been announced by Aetna Mfg. Co., Oak Park, Ill. It has an eccentric aligning bushing in the adapter head which aligns spindle, column and adapter.

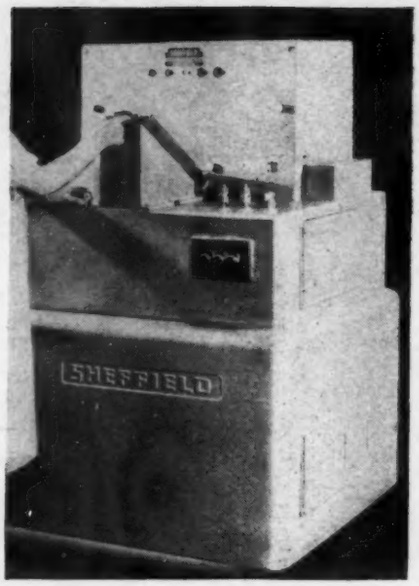
The tool supplies bushing support to the drill or end mill in addition to the spindle chuck. It is designed to prevent chattering and inclination of the drill due to drift. It is said that overlapping holes can be drilled without punch marks or run-out.

Filler bushings cover bushing range up to ½ in.

Sheffield Piston-Gaging Machine Segregates Into Eight Classes

The Airlectric automatic gaging machine has been developed by Sheffield Corp., Dayton 1, Ohio. The machine checks the average outside diameter of shock-absorber pistons and segregates them into eight classes at the rate of 3600 per hr.

Excessively oversized pistons are rejected by an Electrichek gaging head. The remainder of parts are inserted in a tungsten-carbide air ring connected to a series of Airlectric gaging heads. The heads determine



the part sizes and light one of five signal lights which indicate the sizes by prearranged colors. The lights come on if the parts are within minimum or maximum tolerance. The operator can thus inform grinding-machine operators to what range they are grinding parts.

The pistons then pass into receptacles depending on size: undersize, oversize, or one of the five acceptable classifications.

Leeds & Northrup Electromax Controls Oven Temperatures

The Electromax, a temperature control for applications where indicating and recording are not required, has been announced by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa. It is used for control of ovens, baths and other units.

Consisting of a Wheatstone-bridge circuit with a vacuum-tube amplifier as a detector, the Electromax signals and controls only, though temperature readings can be taken manually with it. Standard ranges are 0 to 250 and 0 to 1000 F.

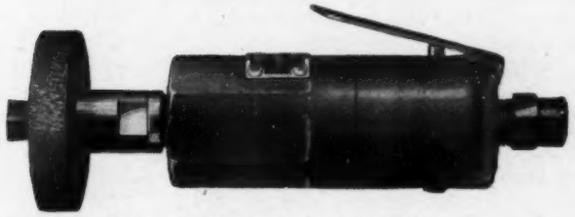
FASTER FINISHING WITH CLECO LIGHT GRINDERS

● For finisning forgings, dies, metal patterns, castings and similar work, you can't beat Cleco Light Grinders. They are light in weight, small and easily handled, yet pack plenty of power. The No. 214 series of Cleco Grinders is available at speeds of 14,000 and 18,000 R.P.M. and are governor controlled, while Model 12 is faster at 20,000 R.P.M. Fitted with ⅜", 24 S.A.E. thread spindles. Exhaust deflector included.

Standard equipment consists of spindle nut and washer, and ¼" collet chuck. Spindle extension 1½" or 3" long furnished, in lieu of collet chuck, when specified. Dead handle supplied when so ordered.

Bulletin 80 describes these light grinders in detail, as well as furnishing complete data on the entire line of Cleco Rotary Grinders. Ask for it!

Working inside a casting.

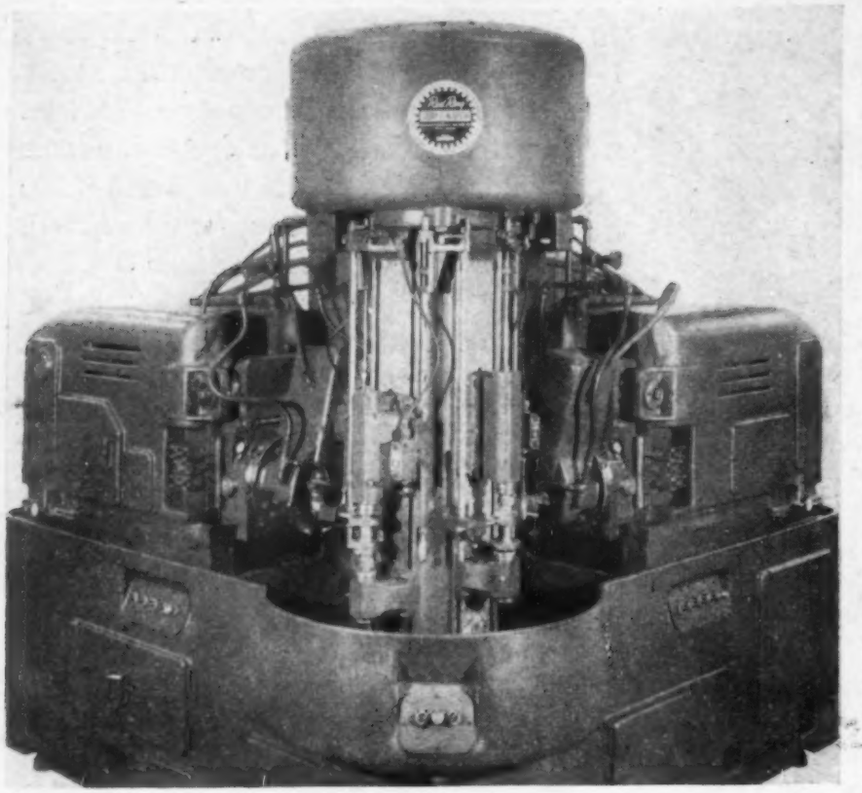


Above, a Cleco 214J light grinder. Below, a Cleco No. 214 smoothing up an aluminum casting, with a rotary file.

THE CLEVELAND PNEUMATIC TOOL CO.

3781 East 77th St. • Cleveland 5, Ohio DISTRIBUTORS IN ALL PRINCIPAL CITIES

Red Ring GCS Gear-Shaving Machine Incorporates Crossed-Axes Shaving



Two cutting stations and four work stations increase production rates on the Turmatic gear-shaving machine

The model GCS Turmatic, a Red Ring gear-shaving machine, has been developed by National Broach & Machine Co., 5628 St. Jean at Drummond, Detroit, Mich. Said to increase production rates two and one-half times or more over prior models, the machine has two cutting stations and four work stations. It incorporates the principle of crossed-axes shaving.

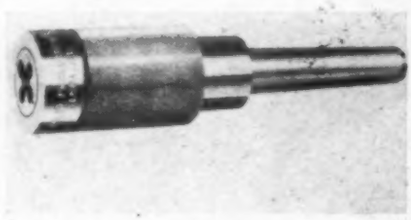
The central turret has four sides and is equipped with four vertical sets of headstock and tailstock. Two cutter heads spaced 90° apart simultaneously mesh with work gears on adjacent turret faces. After the cutting cycle is completed, the turret indexes 180° and presents two fresh gears, leaving the other two stations free for loading and unloading. The indexing and meshing cycle is approximately 4 sec.

A cutter locator and a nose piece position the gear teeth. The nose piece also rejects oversize gears and eliminates the necessity of opening and closing guards and reaching behind the work gear to position it.

The cutter heads are set independently to handle similar or different gears. Safety lights indicate that the machine is in operation, while automatic safety devices stop the machine and prevent damage to cutters when work is oversize or improperly positioned. The same cutters used on other Red Ring machines can be used on the Turmatic.

Gears can be crown-shaved on the machine, cam adjustment varying the amount of crown.

Falls Tap and Die Holder Releases When Work Is Done



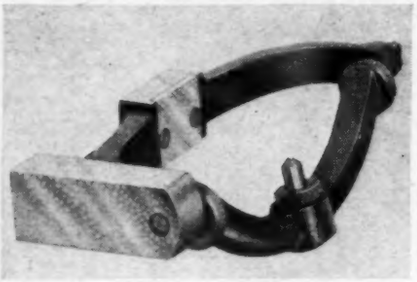
A releasing tap and die holder designed for screw machines and ordinary engine lathes has been developed by Falls Products, Inc., 120 Genoa St., Genoa, Ill.

The product is made in three shank sizes: No. 2 Morse Taper for engine lathe tailstock sockets, and ⅝- and ¾-in. straight shank for screw-machine turret heads. All sizes use a 1-in. button-type die for external threading or standard taps for tapping holes.

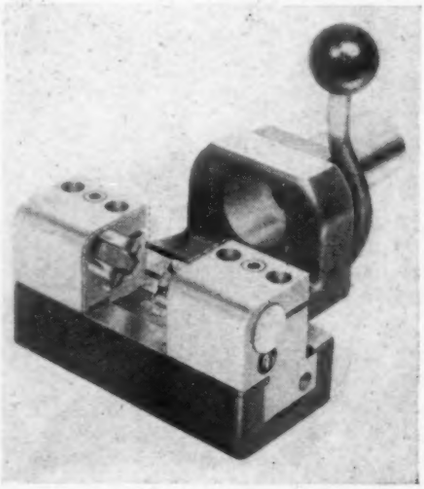
The holder housing releases automatically at the conclusion of operation and backs off when rotation is reversed and turret is withdrawn.

Radius Dresser and Knurling Tool Made by Universal Vise and Tool

A precision radius dresser and a retractable knurling tool have been developed by Universal Vise and Tool Co., Parma, Mich.



The radius dresser, designed for grinding wheel dressing, produces convex, concave and compound radii from 0 to 1 in. on wheels to 7-in. dia. Made of cast iron, the dresser is held vertically or horizontally on a magnetic chuck. It is said to hold tolerances as small as 0.0001 in.



The retractable knurling tool is adaptable to engine or turret lathes. It features the ability to knurl long, thin work and at the same time clear threads, pilots and other sections of the same diameter as the portion to be knurled. Adjustable knurls permit formation of different knurl patterns up to 2-in. dia.

Furniture Builders are "Sitting Pretty"

AND SO ARE THEIR CUSTOMERS...

... when Costs are Cut — Appearance and Durability improved — by AMERICAN PHILLIPS SCREWS

IN THE FACTORY: The most modern fastening for all types of furniture is the American Phillips Screw. Easy to handle . . . lightning-fast and automatically straight to drive . . . fumble-proof, slip-proof and damage-proof . . . American Phillips Screws deliver top savings on any fastening job in any type of plant from furniture to railroad cars. Put these engineered screws on *your* costs — *and watch your time-savings shoot up as high as 50%!*

IN THE SALESROOM: One of the hallmarks of fine furniture and other household appointments is the decorative, straight-set, unburred head of the American Phillips Screw. More and more quality-minded buyers look for this distinctive feature—*both* for the sake of appearance, and as a *visible assurance* of sturdy construction and long service—their money's worth and then some! *Your* product should have this cost-cutting, sales-building advantage.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Bldg.

AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

Two New Crankshaft Regrinders Added to Line of Landis Tool

The addition of two crankshaft regrinders to the present line of five sizes has been announced by Landis Tool Co., Waynesboro, Pa. The 18x30-in. size will handle Ford, Studebaker Champion and Willys crankshafts. The 18x42-in. size will handle Chevrolet, Plymouth and other 6-cylinder passenger car and light truck crankshafts.

Two Hammond Polishing Lathes Are Single- and Variable-Speed

A hand-operated dial controls the speed of the Model VROL variable-speed polishing and buffing lathe

Two single-spindle polishing and buffing lathes have been added to the line of Hammond Machinery Builders Inc., 1600 Douglas Ave., Kalamazoo, Mich. Both lathes have a spindle overhang of 8-in. to permit the handling of bulky parts. The motor on each is enclosed in the base.

The Model VROL is a variable-speed single-V-belt drive lathe with a 3-hp., 50- or 60-cycle motor. On 60-cycle current it gives spindle speeds of 1500 to 3000 rpm. On 50 cycle it gives 1250 to 2500 rpm.

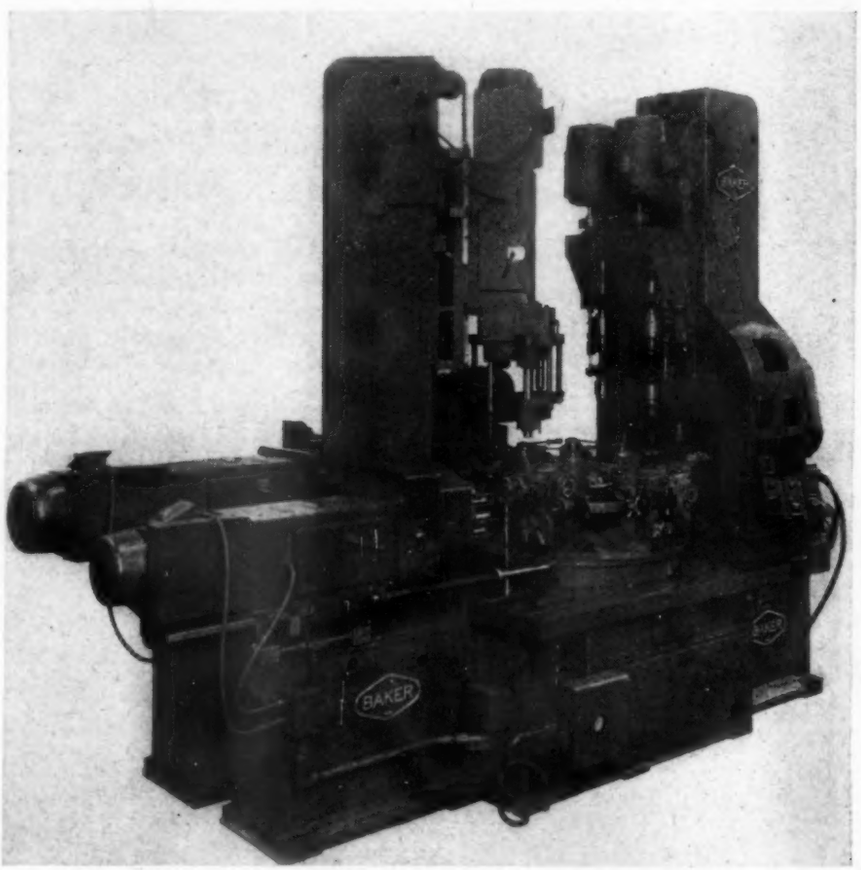
The Model ROL is a single-speed multi-V-belt drive lathe with a 2- or 3-hp., 50- or 60-cycle motor. Any single speed from 1200 to 3600 rpm. can be furnished.

Other changes in the Hammond line include improvements in the design of the No. 3 and No. 4 backstands. Primary change is in the pulley, which is now made of aluminum alloy and mounted on sealed ball bearings. The lighter construction aids in keeping the abrasive belt on the pulley and wheel.

EASY-TOTE TRUCK — Departmental truck available from Easy-Tote Products, Inc., Arcade, N. Y., accommodates standard tote pans. Loading is accomplished by tilting the plate and by operating the crank and handle

Industrial Gloves Co. Handguard Leaves Thumb, Fingertips Free

The Steel-Grip Handguard No. 15407 has been added to the line of Industrial Gloves Co., Danville, Ill. The guard leaves thumb and fingertips free for picking up material and is designed for jobs that require light protection of palm, first finger and palm side of the little finger. It is made of split cowhide and is steel stitched. An elastic web band runs across the back of the hand. Sizes for men and women in pairs or for either hand are available.

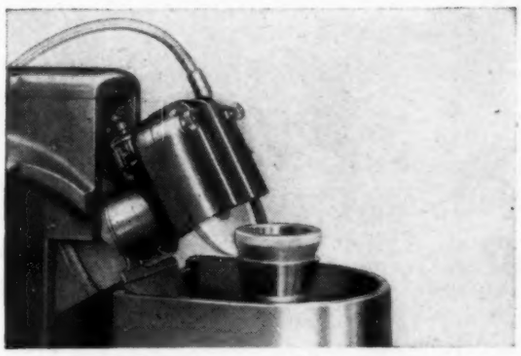


SPECIAL MACHINE—A multiple-operation machine for the production of gas-regulator bodies has been developed by Baker Bros., Inc., Toledo 10, Ohio. The machine completes all drilling, boring, reaming, facing and testing operations in the production of the cast-iron regulators. An automatic power-indexing table with 4 stations has 10 independently fed auxiliary units built around it. Each station is arranged to rechuck one part and chuck one new part

TAFT-PEIRCE

6″ ROTARY SURFACE GRINDER

- **Grinds Surfaces Accurately Flat**
- **Ends Slow and Complex Set-ups**
- **Cuts Grinding Time and Operator's Effort**



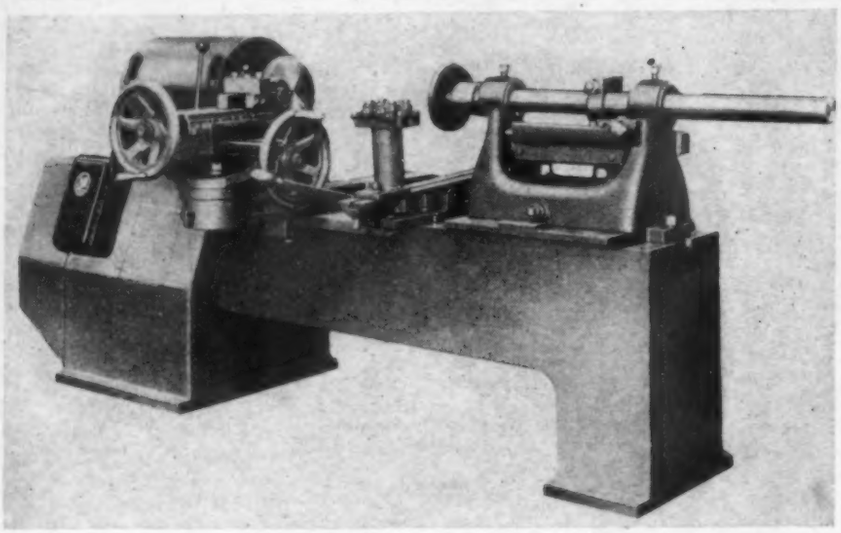
* The Taft-Peirce *Tilting Wheelhead* enables the machine to grind up close to an undercut as illustrated.

Distinctly unconventional in design, this compact machine will give you an entirely new understanding of accuracy, flatness, and finish — as imparted to the plane surfaces of gages, tools, and small parts.

The exclusive Taft-Peirce *Tilting Wheelhead** simplifies difficult angle and shoulder work. Wheel spindle swivels from horizontal to 30° below wheel center. Work spindle is trunnion-mounted so chuck can swivel 7½° forward or back — permitting accurate grinding of saws, gear shaper cutters, etc. And even the smallest work-pieces are held securely by the Taft-Peirce Superpower Magnetic Chuck. For complete details and accessory equipment, write for illustrated bulletin to:

The TAFT-PEIRCE MFG. COMPANY
Woonsocket, Rhode Island

E. W. Bliss Co.'s Spinning Lathes Make Secondary Shaping Operations



Drawn or spun shells are handled by this second-operation lathe at a rate commensurate with primary operation in the toggle press

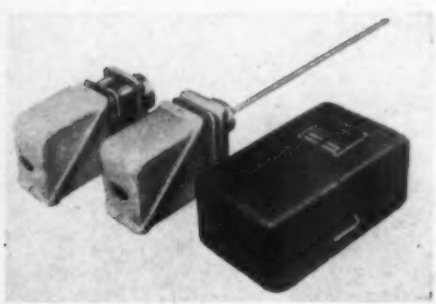
A line of second-operation spinning lathes has been developed by E. W. Bliss Co., Detroit 2, Mich. The lathes are designed to bulge, neck, bead, wire, flange, curl and trim a variety of drawn or spun shells after they have gone through primary operation in a toggle press.

The V-belt motor drive and gear box are totally enclosed in the welded-steel frame with no weight increase over prior designs. A combination multiple-disk friction clutch and brake are said to furnish instant stopping and starting, and a fast-acting tailstock toggle clamp permits rapid loading and unloading. The offset adjustment of the tailstock allows inside form rolls to replace sectional chucks in necking operations.

The lathes come in two sizes with up to 30-in swing and 92-in. bed length. The headstock spindles run on Timken bearings. Model No. 15 has instantly variable speeds of 275, 365, 615 and 1140 rpm. and weighs 1500 lbs. Model No. 16 has speeds of 180, 370, 675 and 1140 rpm. and weighs 3000 lbs.

A wiring-rest attachment can be pivoted by a tilting lever to approach the work at any angle. A tilting rest for both trimming and wiring, and an attachment for trimming straight shells without flanges are available.

Fireye Flame Failure Safeguard Protects Industrial Oil Burners



The Fireye Photoelectric Flame Failure Safeguard, a protection against explosion in industrial oil burners, has been developed by Combustion Control Corp., 77 Broadway, Cambridge 42, Mass. Fireye automaticlly turns off the fuel supply when the flame fails.

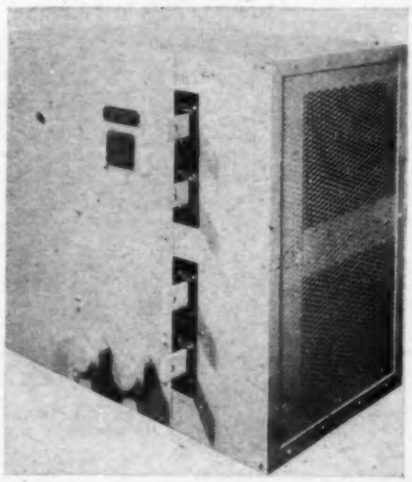
The programming control provides setting of oil-valve delay and post ignition period in seconds upon installation. Timing is accomplished through a synchronous motor.

A. O. Smith's ac. Welders Perform Medium-Heavy Jobs

A line of general-purpose ac. welders of 150-, 200- and 250-amp. ratings are available from A. O. Smith Corp., Milwaukee 1, Wis. These Smithway welders are designed for light to medium-heavy jobs and contain the basic features found in the heavy-duty Smithway welder models.

Desired current is obtained by the use of a hand wheel at the top of the unit. Presettings are read on the 14-in. amperage scale. There is a dual welding range: plugging into "High" gives a normal current range at approximately 56 v. open-circuit, and "Low" gives low current range at approximately 80 v. open-circuit.

The ac. welders are said to provide freedom from magnetic arc blow, permitting higher currents and larger electrodes. High power factor and low "no-load losses" are said to provide power savings. Built-in capacitors (standard on "C" models) furnish corrective leading kva.



ELECTROPLATING RECTIFIER — Wagner-Tiedman electroplating rectifier with a rectifying area of over 4300 sq. in. is available from Wagner Brothers, Inc., 402 Midland Ave., Detroit 3, Mich. Selenium-on-aluminum cells, said to take momentary overloads up to 1000%, are employed. The unit occupies a floor area of 5½ sq. ft. and is 34 in. high

WELL INFORMED ENGINEERS . . . Specify

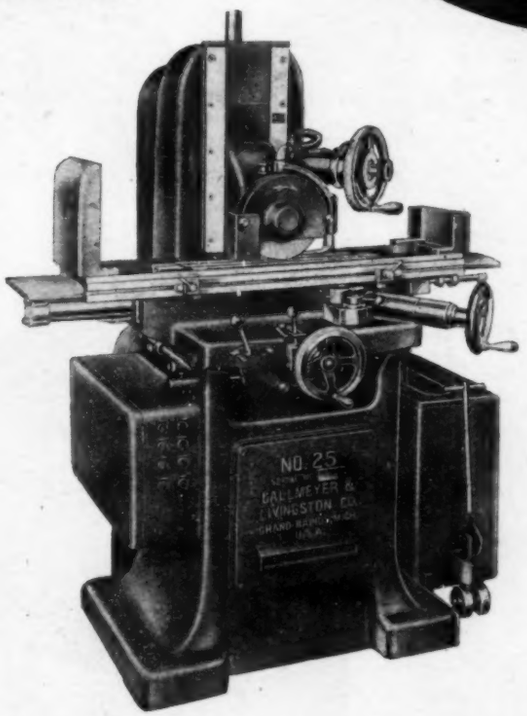
GRAND RAPIDS GRINDERS

• Every Grand Rapids Grinder, large or small, incorporates all of the essential features for fast, efficient, low-cost production.

For the manufacturer of small sized products, Grand Rapids No. 25 and No. 4 Grinders will solve the Tool Room grinding problems on dies and cutting tools. Grand Rapids Grinders are built in many sizes for many grinding jobs.

• No. 25 Grand Rapids Hydraulic Feed Surface Grinder

Complete information in Bulletin GL-101



• No. 4 Grand Rapids Universal Cutter and Tool Grinder

Complete information in Bulletin No. 1045

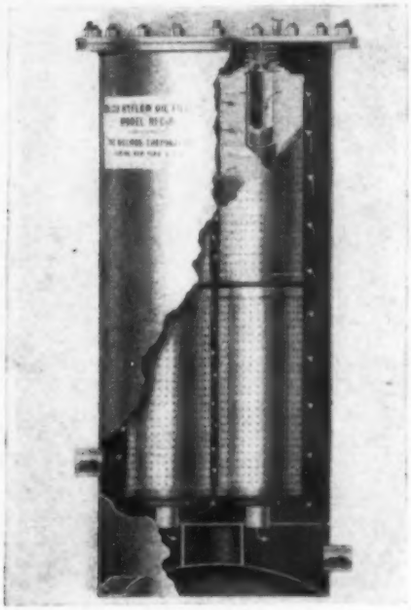
What "GRAND RAPIDS" Quality Means:

G & L cast their own close-grained gray iron, machine all parts to micrometric tolerances, and precision-assemble grinding machinery of unsurpassed performance. ***Grand Rapids*** means ***top*** quality in grinding machinery.

GALLMEYER & LIVINGSTON CO., 330 STRAIGHT AVE., S.W., GRAND RAPIDS 4, MICHIGAN

Parts and Materials

Hilliard's Line of Oil Filters Uses Navy-Type Filter Cartridges



A line of lubricating, fuel and industrial oil filters is announced by The Hilliard Corp., 102 W. 4th St., Elmira, N. Y. The units are steel and utilize from 1 to 18 filter cartridges measuring 7¼ x 18 in. The cartridges have the dimensions of the "Navy Type."

The Hilco units may be operated as by-pass or full-flow filters. Pressure to force the oil through the filter can be provided by an auxiliary motor-driven pump or directly from engine or equipment pressure. The filter units are available with or without heaters.

Filter elements are made of Hiltex-cellulose for additive-type oils or Hilite-fullers earth for straight-run mineral oils. It is said that the units give micronic filtration and high flow rates at relatively low pressures.

Two GE 125-W. Industrial Lamps Give Lower Oven Temperatures

Two 125-w. infrared industrial lamps have been announced by General Electric Lamp Department, Nela Park, Cleveland, Ohio. One lamp has a G-30 bulb and the other has a R-40 reflector-type bulb. Both lamps have medium skirted bases and are rated in excess of 5000 hr.

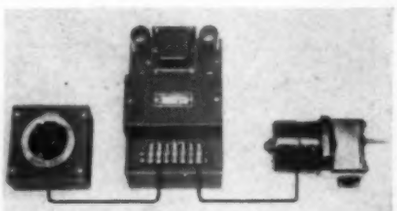
The 125-w. models are designed for oven applications where even distribution of radiant energy is desired, but where temperature should be less than that supplied with 250-w. lamps. They can be used interchangeably with 250- and 375-w. G-30 and R-40 lamps.

Mansfield & Green Check Valve Stops Leakage with Double Seal

A check valve with a double seal to eliminate leakage and loss of pressure is available from Mansfield & Green, Cleveland, Ohio. The seal utilizes a metal-to-metal seat plus a resilient- or synthetic-rubber ring seal on the check-valve poppet. Line pressure forces the ring to the metal seat and thereby increases sealing force.

Sizes vary from ⅛- to 1-in. standard pipe thread. Pressure range is 10,000 psi. Grit as large as 0.010-in. dia. is said not to cause leakage.

Synchro-Link Remote Control Positions One or More Motors



The Synchro-Link, a remote control for fractional or integral-hp. motors, up to 35 hp. has been developed by Yardeny Laboratories, Inc., 105-107 Chambers St., New York 7, N. Y. The unit will position one or more distant motors and is used in applications including control of speed transmissions, machine tools, valves and furnace doors.

Working on the principle of a self-balancing electronic bridge, it consists of a Master Control for manual or automatic control, a Synchro-Link electronic controller and a potentiometer geared to the motor or coupled to the load.

Two controls permit adjustment of accuracy or dead zone (allowable motion of control shaft before correcting action of motor is initiated), and adapt characteristics of the system to different inertia values of motors and loads.

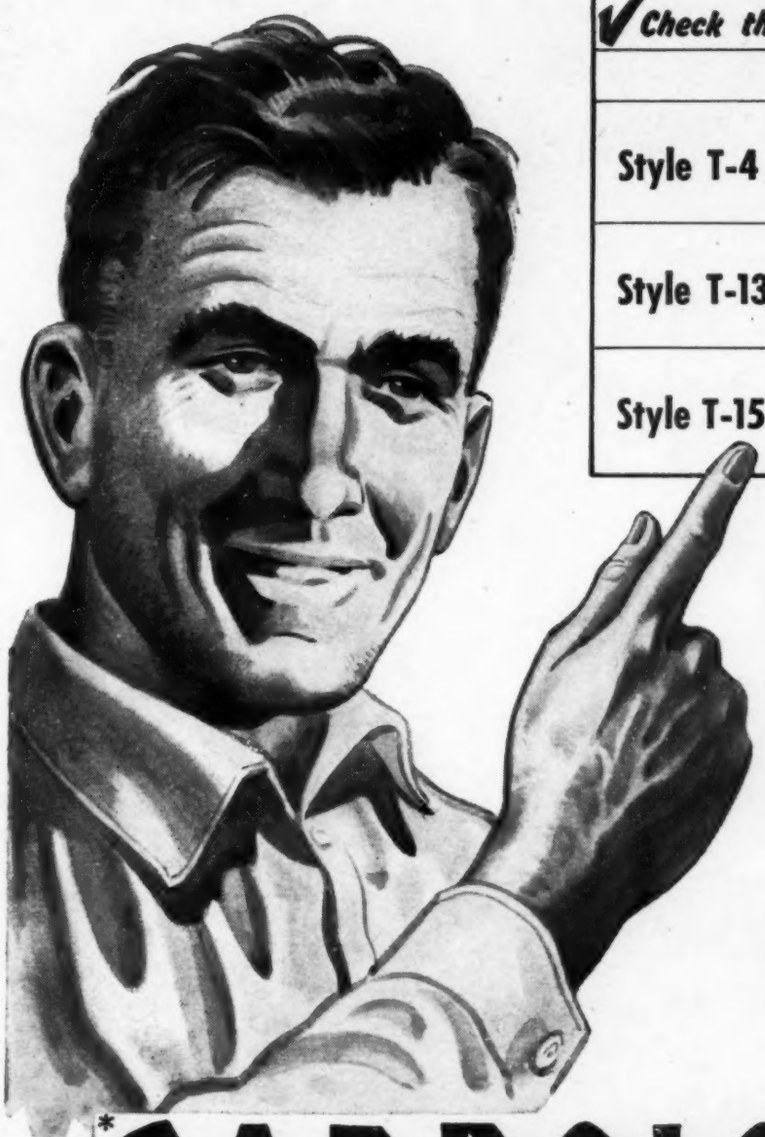
Spray-Peel Strippable Plastic Resists Moisture and Abrasion

Spray-Peel, a strippable plastic compound, has been announced by Eronel Industries, 5714 W. Pico Blvd., Los Angeles, Cal. Applied by brush or spray, the compound is quick-drying and has adhesive qualities to give sealing and tensile properties to provide stripping.

Used during the war for overseas-shipment protection of aircraft, the product is said to have high resistance against moisture, abrasion, aromatic spirits and oils, and acids and alkalies. It is non-toxic.

SHEAVES—A and B lines of QD sheaves announced by Worthington Pump and Machinery Corp., Harrison, N. J., feature improved groove-belt fit and reinforced arm construction. The A line has groove sizes to match A-belts and the B line for B-belts

CAN YOU AFFORD NOT TO USE STANDARD CARBOLOY* TOOLS ...AT PRICES THIS LOW?



✓ *Check these prices against ordinary tools:*

TOOL	PRICE
Style T-4 5/16" sq. Turning Tool	$ .84
Style T-13 3/8" sq. Turning Tool	.90
Style T-15 3/8" sq. Threading Tool	1.14

When you add up improvements like these:

—Big production-increases—excellent finish—extreme accuracy—the elimination of extra operations—and vastly increased tool life . . .

. . . Obtained at an initial investment cost but little more than ordinary tools, *and actually lower in some cases . . .*

Don't you come face-to-face with the question: "Can we afford NOT to use Standard Carboloy* Tools?"

Investigate Carboloy* "Standards" for *your* plant—write for Catalog GT-175R. Carboloy Company, Inc., 11149 E. Eight Mile Ave., Detroit 32, Michigan.

*CARBOLOY (TRADEMARK) CEMENTED CARBIDES

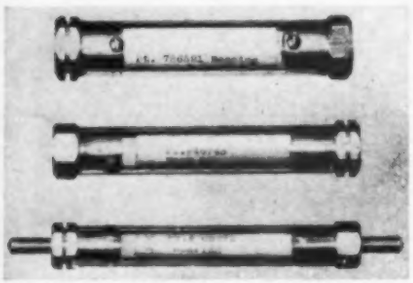
AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS

STOCKED IN 73 CITIES COAST TO COAST

Ward Leonard's Motor Drive Operates Multiple Rheostats

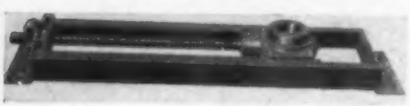
A small motor drive for rheostats is made by Ward Leonard Electric Co., Mount Vernon, N. Y. The unit is designed for remote and automatic operation of single or multiple rheostats controlling generator voltages, motor speeds, lamp intensities and other units.

The "60A" drive has a 13-in. dia. and is approximately 7 in. high. It can be used with 115- or 230-v. ac. or dc., has 30- or 60-sec. travel.



TRANSPARENT GAGE HANDLE—Vis-U-Trol transparent gage handle is made by Industrial Development Associates, Inc., 223 Spruce St., Bloomfield, N. J. It is made of a lucite tube into the ends of which are inserted steel gage ends. Data can be placed within the handle on cards. The product is available in SAE Nos. 1, 2 and 3

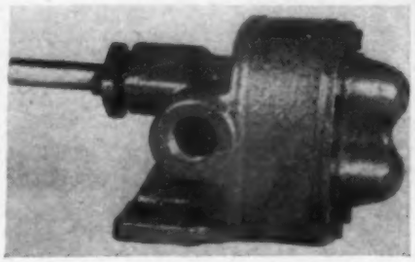
Dodge Ball-Bearing Take-Up Used for Conveyor Service



The type SC steel-frame ball-bearing take-up for conveyor service is announced by Dodge Mfg. Corp., Mishawaka, Ind. The unit has a ball-bearing inner unit enclosed in a cast-iron housing. The housing is provided with ways on each side for supporting guides and a hole for the unthreaded end of an adjusting screw. The welded-steel frame is designed to provide rigidity without excess weight. Adjustment is by means of the brass capstan-head nut.

Also announced is the type SC ball-bearing flange bearing, which is self-aligning and has deep-groove precision ball bearing with long inner race. It is suitable for mounting against vertical or horizontal supports. The back face is machined.

Worthington's Rotary Pumps Couple to Electric Motors



A line of general-service rotary pumps has been developed by Worthington Pump and Machinery Corp., Harrison, N. J. Available in six sizes, the G. A. rotary-type pumps come in various mountings up to capacities of 51 gpm. at 100 psi.

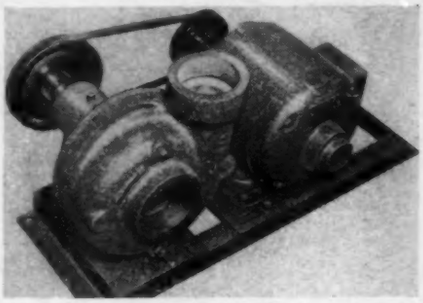
The models are suitable for direct coupling to electric motors. They incorporate four-bearing construction and special herringbone rotors. Built-in lubrication prevents liquid contamination.

Denison's High-Pressure Pumps Are Constant-Displacement Type

The Denison 3500 Series Hydroilic pumps have been announced by The Denison Engineering Co., Columbus 16, Ohio. Of axial-piston, constant-displacement type, the three pumps in the series are rated at 3500 psi. for continuous-duty operation. Higher pressure can be used for intermittent operation.

The Hydroilic pumps deliver 6, 17 and 32 gpm. respectively at 1200 rpm. and are said to have volumetric efficiencies of not less than 95%.

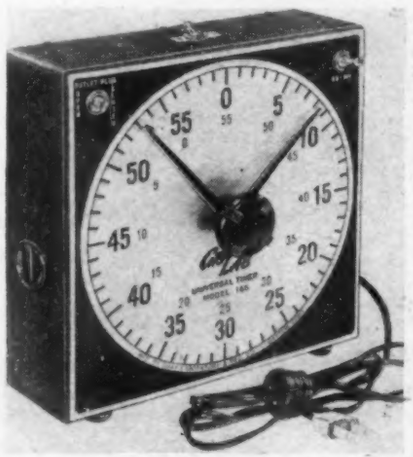
Allis-Chalmers Pedrifugal Pumps Made to Operate in Any Position



A line of Pedrifugal pumps has been developed by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The bronze-fitted cast-iron, pedestal-type centrifugal pumps come in three sizes: 1x1, 2x2 and 3x3 in.

Capacities are from 10 to 500 gpm. at heads from 10 to 100 ft. with power requirements from ¼ to 15 hp.

Suited for applications including diesels, machine tools, air conditioners and commercial washers, the pumps will operate in any position. They are especially designed for use with Texrope V-belt drives, and have an infinite range of capacities depending on sheave size and power.

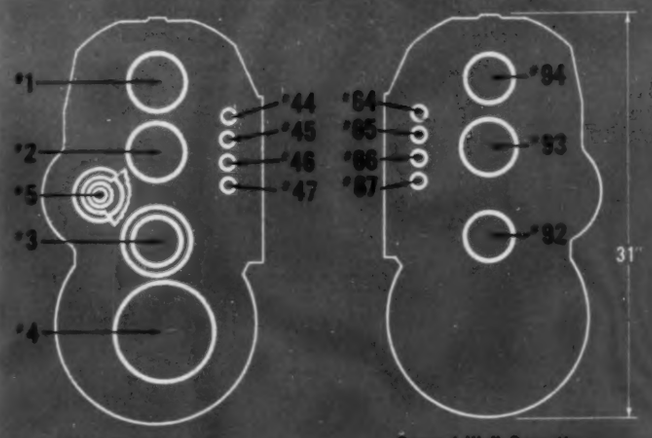


UNIVERSAL TIMER—GraLab Universal times appliances in 1-sec. intervals up to 60 min. Made by Gray Laboratory & Mfg. Co., 43 W. Apple St., Dayton 2, Ohio, it can be used to automatically break or make the circuit at the expiration of pre-selected time or as an elapsed time indicator

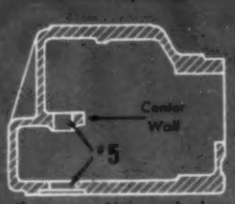
Multi-precision boring plus production

NATCO BORING MACHINE

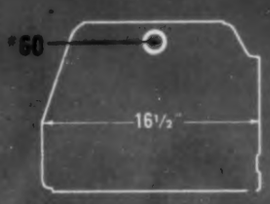
bores holes ranging from .993" to 8.064" diameter



First Wall Operations — Second Wall Operations



Cross section and view to show #5 hole



Drilled by Rear Head

Seventeen transmission case holes up to 8.064" diameter are bored simultaneously within .001", plus or minus, and one hole drilled, on this NATCO special 3-way horizontal boring and drilling machine. The machine is arranged with hydraulic feed. Stationary type fixture accommodates one part while the operations are performed.

RIGHT-HAND HEAD. Combination rough and finish bore Hole #1 in first wall to 3.037" diameter and Hole #94 in second wall to 3.347" diameter. Combination rough and finish bore Hole #2 in first wall to 3.937" diameter and Hole #93 in second wall to 3.937" diameter. Combination rough and finish bore and counterbore Hole #3 in first wall to 3.751" bore and 5¼" counterbore and combination rough and finish bore Hole #92 in second wall to 3.672" diameter. Combination rough and finish bore Hole #4 in first wall to 8.064" diameter. On Hole #5, first wall, combination rough and finish bore to 2" and counterbore to 3 9/16" diameter; on center wall, combination rough and finish bore to 1.385" and face boss to 1¾" diameter. Ream four holes #44 to #47 inclusive to .993" diameter.

LEFT-HAND HEAD. On 4 holes #64 to #67 inclusive, combination finish ream to .993" and counterbore to 1½" diameter.

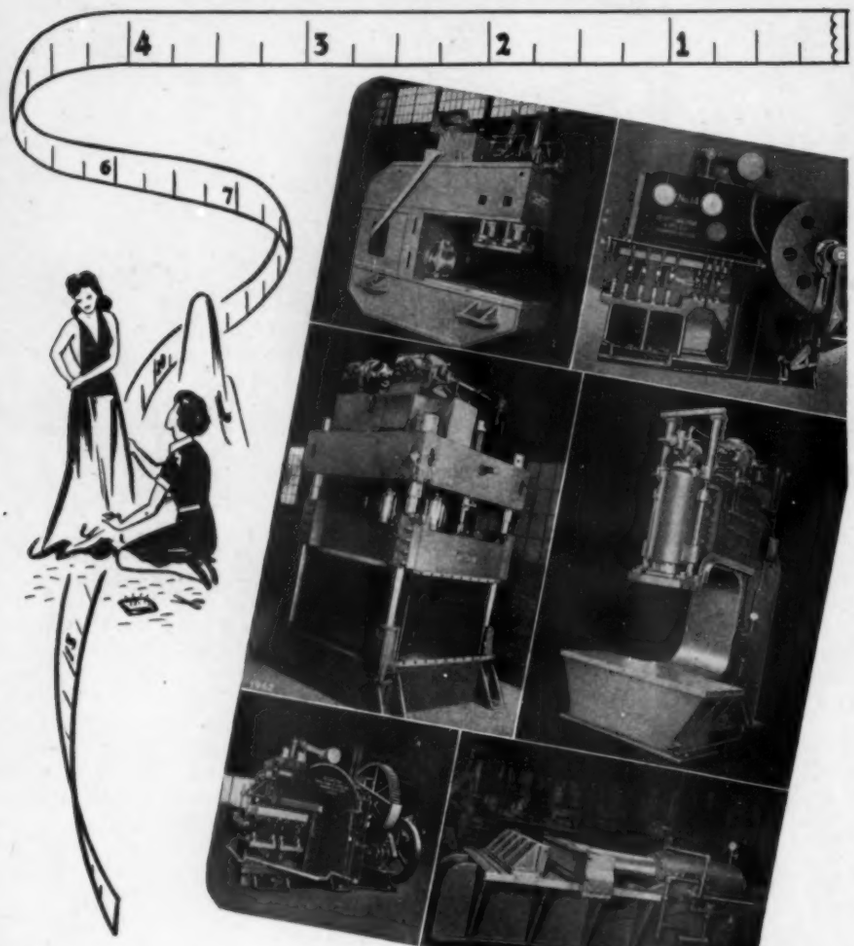
REAR HEAD. Drill one hole #60 for 1" pipe tap.

Production is 13 transmission cases *precision bored* per hour. For further details on NATCO boring and drilling machines, write today to NATCO, Dept. A, Richmond, Indiana.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND., U. S. A. • *Branch Offices:* 1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City

BEATTY machines are "Made to Measure"



BEATTY Heavy Metal Working Equipment is built not just to do A job, but to do THE job. Special production problems call for special equipment, and when special equipment must be designed wise industrialists call for a BEATTY engineer. Next time you have a heavy metal fabricating problem, let a BEATTY engineer help you find the answer.

BUILDERS OF:

Mechanical and Hydraulic Punches, Presses, Shears, Spacing Tables, Bulldozers, Pipe Benders and Extruding Machines.

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

ROUND TABLE *Discussion*

ARE TRADE SECRETS WORTH KEEPING?

A great many shop kinks are of no real commercial value, because they can be applied in one shop only.

Shop kinks and trade secrets, which are applicable to other manufacturers' products, should, as far as possible, be kept secret. This is not easy to do, and is one of the reasons why it is a bad policy to discharge old employees who can give away the secrets of processes to rivals.

It is far cheaper to give pensions to these men, on the condition that they do not divulge the firm's secrets.

Trade secrets often get out in this way, or by discharged employees taking trade secrets and the results of experience with them to other firms. Most firms have secrets which cannot be patented and about which old employees must know.

In order to prevent leakage of secrets through these men, I would suggest that trusted employees of long standing in the firm, should be given annual increases. These should not be in cash, but consist of shares in the company. This would give them an interest in the company, whether actively engaged in it or not.

Trade secrets and processes must be closely guarded, and it is advisable for anyone who must know these secrets to be a shareholder in the firm. The necessary shares should be purchased out of wages.

W. E. Warner
Essex, England

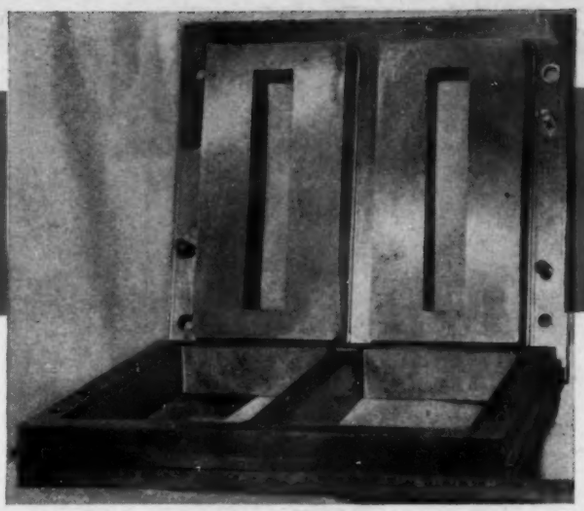
•

OLD MAN JONAS LOOKS ON

Perhaps we owe more to our Old-man Jonas's than may appear on the surface. Effective supervision is not simply a matter of activity, or energy, or education, or even production knowledge alone—although each has definite value. The most important qualification is that which comes from having done the job: *experience.*

A young man may be well educated, have academic qualifications of a standard which the Jonas's could not understand, but, and it is a big but, he could not have the old man's experience. That can be acquired only by doing the job, starting at the beginning in less-important

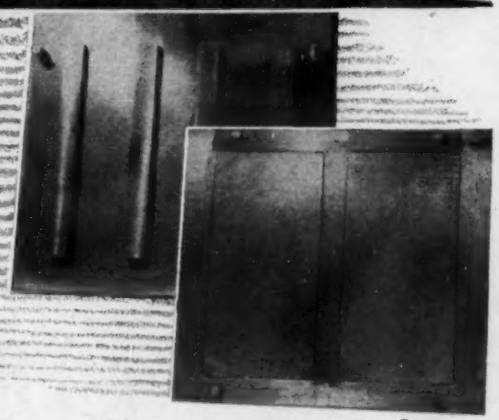
Will You Take $3000.00 For 3 Minutes Time



THREE MINUTES SPENT READING THIS AD MAY SAVE YOU

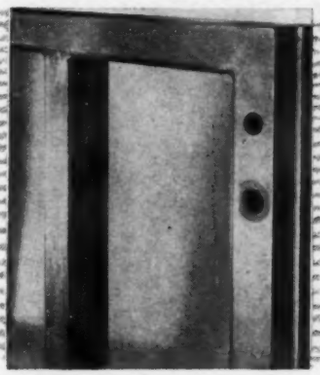
THOUSANDS OF DOLLARS PER YEAR IN DIE OR MOLD MAKING COSTS

Fast machining . . . smooth finish . . . longer tool life . . . are the qualities that can save you time and money, when you use *Speed Case* or *Speed Treat* Steel. MACHINE SPECIALTIES COMPANY, LYNN, MASS., for example, by using *Speed Case* plates instead of mild steel to make the mold set shown here, reduced machining costs over 51% . . . finish grinding operations were completely eliminated. . . . *a saving of hundreds of dollars in a single job!*



The complete unit, used for molding a large rubber deep freeze gasket, consists of four parts. Main plate and "former" plate are shown above; plunger plate and bottom plate are shown to the right. Overall size is 26" x 28¼". "Former" plate machined from 5" thick plate. Main plate (lying flat) machined from 4" thick plate. A good demonstration of how *Speed Case* saves time and money lies in the making of the main plate. The two rectangular openings were flame cut. After flame cutting, the inside surfaces were finished in a single milling cut, using a fabricated end mill; a slight hand finish with emery cloth producing a satin smooth surface.

On every machining operation *Speed Case* Steel made possible important time savings . . . no matter how intricate the cut. In machining the bottom surface of the main mold, as an example, it was necessary to leave a thin wall or edge around each rectangular open section; this wall had to be .040" thick with an 18° bevel at its base. Free machining *Speed Case* made this a fast milling operation with tolerances easily held.



To save time . . . to save money that can total thousands of dollars per year, investigate your applications for Holliday *Speed Case* low carbon or *Speed Treat* medium carbon steels. Machinability, smooth finish, minimum warpage in heat treating or carburizing are a few of the advantages provided. In die work . . . or wherever considerable machining is required such as in hydraulic valve block production, Holliday steels will be important to you. Write for complete information.

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Speed Case—Speed Treat Plate Division

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posts, and proving one's fitness in the process. Having thus matriculated, it is easier to evaluate a man for bigger jobs.

What are the qualifications needed to control a workshop? To control calls for many qualifications, of which education, important though this may be, is not the major need. Character, which will command respect; knowledge, which will act as a spur to those supervised; and ability to lead, which helps to induce and maintain loyalty, all are needed.

These qualities possessed by an educated man will give any newcomer a grip and a start which, in due course, will make him as efficient and as respected as any other Old-man Jonas who has already passed on.

Some years ago, a fishing smack was making for harbor, the entrance to which was difficult. Outside, she was steered by a strong and energetic young man. On nearing the harbor's bar, however, the tiller was handed to an older and less-energetic man on whose experience, gained during long years, the crew relied for safety.

The experience of a Jonas is not to be found in textbooks; it can best be obtained by understudying the old man, improving on his methods where, when, and if possible.

J. E. Powell
Lincoln, England

•

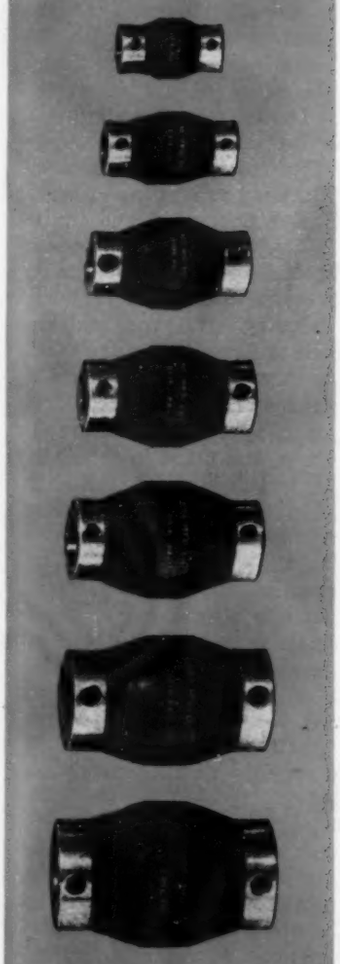
IS APPRENTICESHIP SLIPPING?

Apprenticeship is the training period normally required for an individual to learn the fundamental principles of a trade and prepare himself for the experience and work that lies ahead. Its success or failure may be equally divided between the apprentice organization and the apprentice himself. The ability of the apprentice system to provide the education and the ability of the apprentice to absorb it are equally important.

In the small shop, the apprentice is generally expected to do most of his own training, so that the ability and aggressiveness of the apprentice will govern the degree of success he is able to attain. The apprentice in this type of shop is also deprived of the use of modern-type machines and latest equipment and tools. Often requiring him to use his own initiative in finding a way to do a job with the tools and equipment at hand, which naturally makes for a better all-around mechanic.

Modern production methods in many plants, both large and small,

LORD COUPLINGS
7 SIZES—
TO 1 H.P.



THE true cost of component parts in your product can only be calculated by considering the overall assembly cost. Take couplings as an example. A few cents saved by purchase of inferior couplings often results in slower assembly at a cost much greater than the saving on the coupling itself.

LORD Flexible Couplings are designed to cut those "hidden production costs", and to improve the performance of your product in many ways. Good engineering and intimate acquaintance with production requirements have been combined to create a new conception of coupling performance. Write for your copy of Bulletin 200-C, and see for yourself what LORD Couplings can do to speed production and improve performance.

LORD COUPLING AIDS TO PRODUCT AND PRODUCTION

1. **Delivers Smoother Power** by absorbing shaft vibration.
2. **Eliminates Alignment Difficulties** by accommodating more than the usual amount of parallel or angular misalignment.
3. **Quiets Machine Operation** by preventing transmission of noise between shafts.
4. **Increases Life of Bearings And Gears** by cushioning shock and vibrational stresses.
5. **Requires No Maintenance** because there are no moving surfaces to rub, chafe or wear; and therefore, no periodic lubrication is required.
6. **Protects Equipment** by acting as a mechanical fuse. Will break under conditions of extreme overload, disconnecting the driven unit before serious damage is caused.

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They are uniform in size and fabric; over-edged to prevent fraying, and are delivered to your plant after they have been cleaned by a special high-heat process—in any quantity desired, as often as necessary.

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"KEX" REG. U.S. PAT. OFF. NATIONAL SERVICE A CALLAWAY MILLS PRODUCT INDUSTRIAL WIPING CLOTHS

have produced thousands of "operators." To the thoroughly trained machinist, these operators may justly be classed as "unskilled help." It is for this reason that I believe the apprenticeship system is not only slipping, but has already slipped. Industry is failing to provide itself with the proper material to keep itself alive. The training system is the backbone of industry and must not be allowed to give way to the increasing infiltration of machine operators.

Our need is for mechanics—good mechanics—and better than that, for good mechanics that will provide material for supervision and management. An organized and properly manned apprentice-training program is the one sure method that will fill the gap. It takes very little training and experience to enable a competent and willing worker to operate a machine with a moderate degree of success. For this reason, the time spent on actual machine operation in a training program should be kept at a minimum. A great deal more time should be devoted to the methods and reasons for doing things.

Courses provided by an organized system should furnish the apprentice with an over-all coverage of the industry and provide him with the ability to reach out and grasp things beyond the scope of his actual experience. The organized system provides the apprentice with courses covering shop mathematics, blueprint reading, drawing practice, and many other allied branches of the industrial field. Such a program broadens the mind and increases the ability of the average individual, and will supply industry with the material from which to draw for future training and supervisory positions.

Organized apprentice systems not only give an apprentice a thorough knowledge of the plant in which he is training, but include tours of other plants to give a general picture of how the same work is being performed in these factories. The apprentice realizes that there is usually more than one way to do a job. If he is at all ambitious he will no doubt attempt to work out still other methods of his own. He is being stimulated to think, which is one of the most important factors behind the progress of our present-day industries.

In ar organized apprentice program, the apprentice is provided with a competent supervisor who instructs him how to work and operate machines, and also explains the best known method of doing a job and why it is done that way. The super-

SPRINGFIELD MACHINE-TOOL COMPANY

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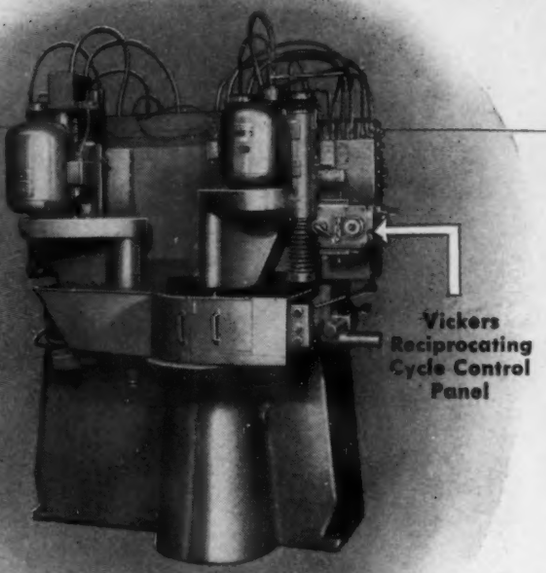
VICKERS

HYDRAULIC CONTROLS

to achieve

- INCREASED PRODUCTION
- BETTER WORK FINISH
- SIMPLICITY OF INSTALLATION
- VERSATILITY OF OPERATION
- PROTECTION OF MACHINE, WORK AND OPERATOR



Springfield Special Purpose Grinder

The manufacturer has utilized Vickers Hydraulic Controls on this special purpose grinder to provide an important increase in production, better work finish, simpler operation, and protection for the operator, machine and work.

The machine grinds the backface and bore of the ring gear in one setup. Each grinding wheel is reciprocated hydraulically in proper sequence. All phases of machine cycle operation are interlocked hydraulically to prevent damage to work and machine.

Vickers Reciprocating Cycle Control Panel provides smooth reciprocation of grinding wheel, thus providing better finish. Stroke lengths are adjustable and maintained accurately thus eliminating unnecessary and time-consuming overtravel for a specific setup. Adjustable speed hydraulic drive of work spindle makes possible the best combination of speeds for better finish.

Other Vickers Gasket Mounted Valves (in panel type assembly shown below) permit low cost installation and greater accessibility for adjustment and maintenance. They centralize hydraulic equipment for space saving and improved appearance . . . piping is simplified.

A Vickers Application Engineer will be glad to discuss with you how hydraulic controls can be used to advantage on your products. Get in touch with nearest office listed below.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.

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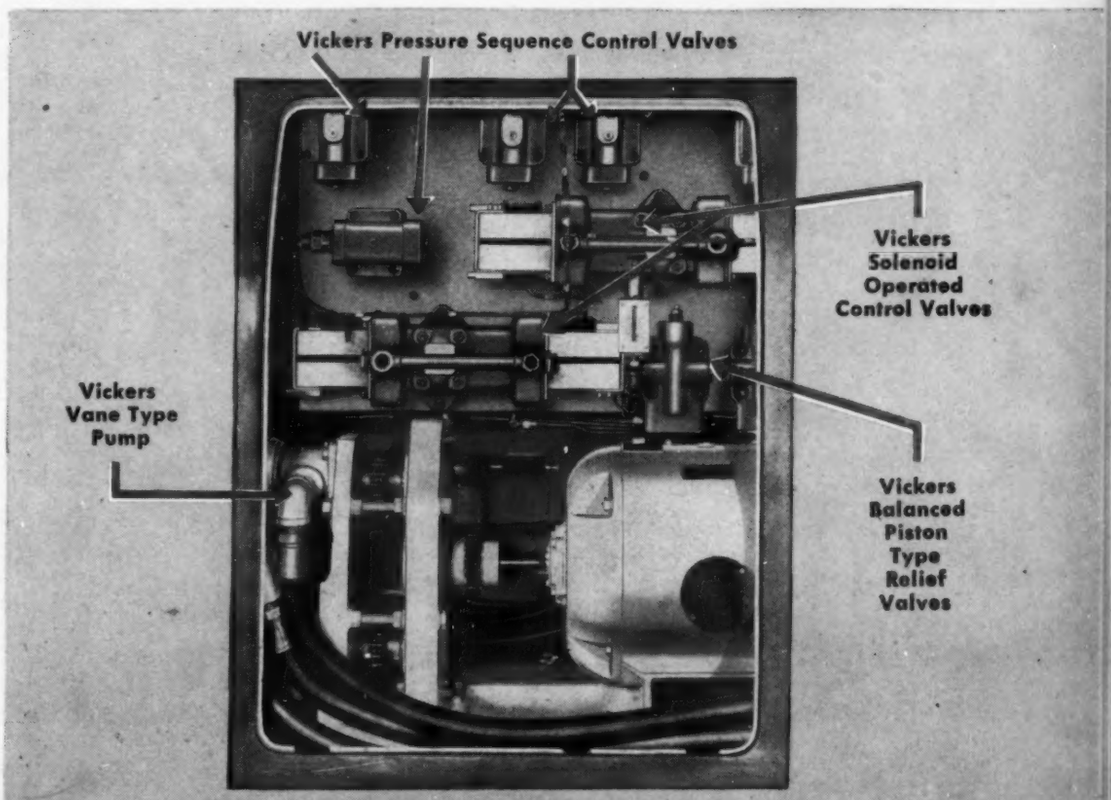
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921


Vickers Pressure Sequence Control Valves
Vickers Solenoid Operated Control Valves
Vickers Vane Type Pump
Vickers Balanced Piston Type Relief Valves

Rear View of Springfield Grinding Machine with Cover Plate Removed

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visor is a man of experience and teaching ability. He devotes his full time to the training of the apprentices and is in a position to personally work out the requirements of each individual. The apprentice is made to feel that he is a part of organization, and not one who is hired to merely turn the wheels of production. He is taught that bigger things are expected of him, which makes him strive to push himself forward.

A. F. Scobic
Milwaukee, Wis.

TO THE EDITOR

PRESENT JOB-EVALUATION METHODS DEFENDED

The article "New Aspects of Job Evaluation" by Ralph Martin McGrath, published in a recent issue, is not entirely fair to all systems of job evaluation in use today or to the methods used by competent job-evaluation engineers.

We have had considerable experience with job evaluation, having co-sponsored an initial effort to introduce this technique in the Milwaukee area in 1938 at which time A. L. Kress came here with a group of engineers and evaluated the production-department jobs for 23 local metal-trades companies.

An engineer who was on our staff at that time worked with Mr. Kress and has carried on the work since then. He carried on this work alone at first, but additional engineers have been added from time to time, until now we have four, all of whom have been trained to use the same theories and standard practice. There are now 130 job-evaluation installations in this area which have been made and kept currently revised by this staff of engineers.

Some of the statements made by Mr. McGrath are, in our opinion, definitely untrue insofar as our application of job evaluation is concerned. He emphasizes that, in his opinion, job evaluations are always controlled by existing wage structures.

On the contrary, the only use we make of existing wage structures is in compiling data to establish a so-called correlation chart. The angle of the curve and its location on this correlation chart are arrived at by using the average wage or earned rates and the point scoring of all jobs involved in the calculation. The curve thus obtained shows the rela-

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Materials, design, markets and competition are on the move. It will require alert management and a flexible plant layout to survive with profit in the days to come. Walker-Turner Light Machine Tools provide both immediate and permanent flexibility—financially and physically.

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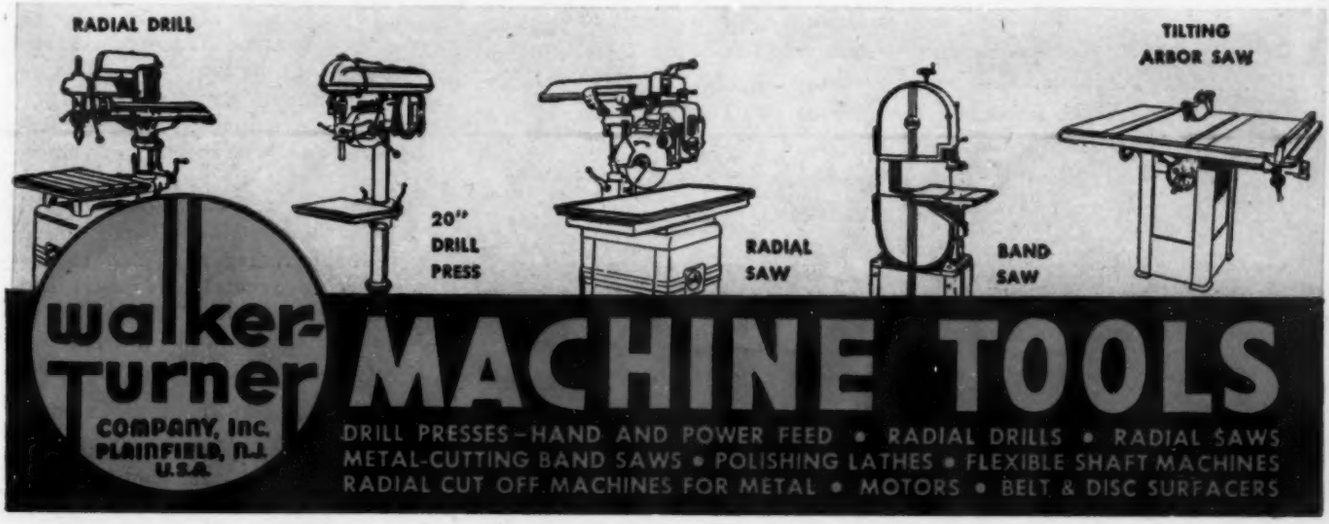
Walker-Turner Light Machine Tools have extreme flexibility of application. They may be operated as bench models, floor models—in groups or as special set-ups. Plan your operations to speed up production in many directions with Walker-Turner Machine Tools—and use the guidance of your nearest Walker-Turner distributor in helping you with the know-how.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PRODUCTION GROOVING AND THREAD CUTTING

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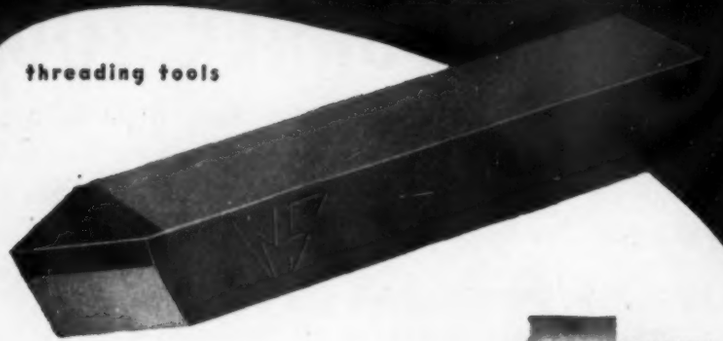
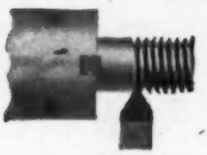
threading tools





Now! Grooving and thread cutting operations can be done faster, more economically with Wendt-Sonis Carbide Tools. Each tool is especially designed for its job. Available from stock in a wide range of sizes and grades. Shanks scientifically hardened. Cutting angles are based on exhaustive tests made under actual production conditions. Use Wendt-Sonis Carbide Tools to increase your production — help combat rising costs. Get complete details by writing WENDT-SONIS COMPANY, Hannibal, Missouri or 580 North Prairie Avenue, Hawthorne, California.

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tionship of all jobs to the median rates indicated.

In making a job-evaluation survey under our method of operation, each job is analyzed independently, without regard to present wage rates or the qualifications of the employee on the job. Furthermore we do have tried and tested standards of the skill, effort and responsibility requirements of a large number of maintenance, machine-shop, structural, pattern-shop and foundry jobs.

We have never claimed that job evaluation is flawless under the system we use. But we do say that during our 21 yr. of experience with local and national employers' associations we have never found any system that can come anywhere near equaling it as a medium for collecting and compiling reasonably accurate area-wage surveys.

It would seem that the extent to which our job-evaluation program has been accepted in this area is a testimonial to its value to local employers despite Mr. McGrath's expressed opinions.

A. R. Peirce, Manager
Employers Association of Milwaukee

Every craft has its equivalent of the logger's Paul Bunyan, the railroad man's John Henry and the steel man's Joe Magarac—the legendary biggest, strongest and laughingest guy who ever lived. He's just a symbol about which tall stories are spun by otherwise honest men. We've dug up a yarn or two about metalworking that we think you'll like . . .

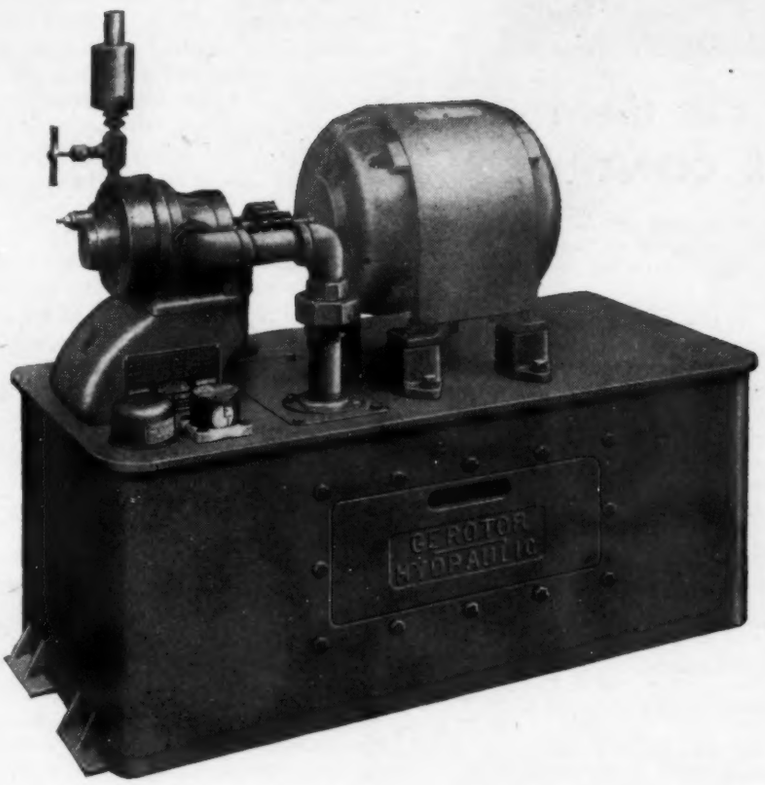
But to maintain our reputation for honesty, we're hanging the title "Fictionary" on 'em as they appear. Once, 15 years ago, we told a tall story straight—about a marvelous material called "automobilium"—and were very embarrassed in trying to explain it to several serious-minded readers who insisted they had to have some. So, this time, we're foolin', honest Injun.

The Tale of the Burmese Lathe

MATT A. NANIAS, while working in a West Coast oil-tool shop in 1910, landed a job to go to the Burma oil

designed for efficiency

GEROTOR HYDRAULIC PUMP UNITS



Available in series 9100 with single pumps . . . series 9200 with double pumps for two separate circuits

Deliver a steady oil flow at continuous pressures up to 1000 p.s.i.

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An unbeatable combination . . . dependable Gerotor hydraulic pumps engineered into tank units complete with relief valve, gauges, filter and coupling. Gerotor pump units are standard for N.E.M.A. frame motors . . . adaptable to special motors, too. Write for catalog folder with full details . . . today!

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Production Delays? Cut them thru McCASKEY TOOL CONTROL

One cause of rising production costs can be stopped at the tool crib by McCaskey Control. Delays or slow service caused by missing tools are expensive. They hold up jobs and pile up idle time for both men and machines. Most of them are unnecessary.

The Van Norman Company, Springfield, Mass., shared its procedure for stopping them with the readers of "American Machinist," in a recent article by Mr. Mitchell Mastalerz. Their production of machine tool and automotive equipment requires three cribs in which the widest diversity of demands are met. The following abstracts indicate how McCaskey Tool Control has assisted them:

OBJECTIVES

1. Least possible loss of productive time for men and machines.
2. Advance planning & preparation of tools to reduce set-up time where as many as 40 tools are required.
3. Their delivery to machines in maximum of 1-hr.
4. Essential tool crib records, accurate and up-to-the-minute.

ACCOMPLISHMENTS

1. Tools from 2 cribs issued in carefully engineered and permanently recorded kits; individually issued from third crib.
2. Kits designated by part and operation number issued on one tool loan order by number with copy of tool list.
3. Special procedure for kits including expensive carbide tools and cutters provides for their use on several operations.
4. Previous experience: 60 delays in a day from tool shortages. Current performance: only 2 or 3, most of them unavoidable, rarely from failure of scheduling or tool service.
5. Lost time at machines decreased; overall efficiency of Operating Department increased.
6. Tool cribs now are giving faster, better tool service, serving the same number of employees and comparable production at less cost and with fewer crib attendants than required by old check system.

Write today for "Tool Kits Cut Costs" by Mr. Mastalerz, from which these facts are taken and similar reports from several other well-known plants. Or, let us have a representative explain without obligation how McCaskey will help you cut your tool expense.

McCaskey INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • COSTS • PAYROLL

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Canada — The McCaskey Register Co., Watford, England

fields on a 3-year contract. The Burmese shop was a small one, but with plenty of headroom and width in passageways. Conditions were so primitive Matt needed all of his native and acquired skill.

One routine job was recutting threads on damaged pipe ends. As lengths were frequently longer than the lathe, the tailstock was replaced by a steadyrest at the end of the bed. Pipe lengths were chucked at the damaged end and simply projected beyond the loosely set steadyrest, all work being done close to the chuck. The pipe was necked in just behind the damaged thread to provide clearance for threading, threaded and cut off. After cutoff, the outer end of the pipe simply dropped onto a wooden V-block.

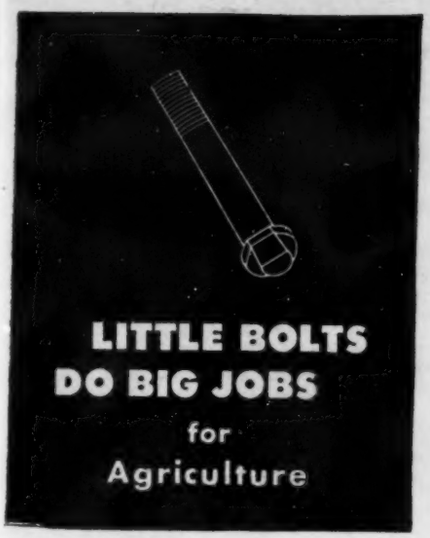
Pipe was usually brought into, and taken out of, the shop by elephants—the reason for the headroom and aisle clearance. These pachyderms had been trained to handle logs, so soon were adept at handling pipe, and so quick to learn that one elephant once picked up Matt's wrench with his trunk and started to tighten the chuck as he'd seen Matt do.

One morning, Matt chucked a long 8-in. pipe, but before starting, found the lathe belt too slack. He ripped the lacing, marked the cut and new holes and set his native helper to work at shortening the belt. Figuring this would take the best part of an hour at Burmese speed, he took the cut-off tool over to the blacksmith for dressing.

As the blacksmith was an old jungle hunter, the redressing was interspersed with some pleasant reminiscences, so it was some time later that Matt got back. As he entered the shop, he stopped cold. Where his lathe had been, there were only three gaping holes that once had held concrete foundations! He rubbed his eyes, but there was no question about it—the lathe was gone.

Matt yelled for a pony and started for the head of the pipe line, figuring that either some fool elephant had taken the whole works, or he ought to have himself checked for jungle fever.

When he got to the line, he made a miraculous recovery — because there was his lathe, still on the final section of pipe, which was already coupled into the line. The native crew was checking off the job, so the lathe stayed where it was. Fortunately, it was a pioneering hollow-spindle job, so oil could be pumped right through it—or so Matt says.



NOWHERE has progress been more pronounced than in the development of farm machinery . . . equipment in which special type nuts and bolts play an increasingly important part. A good example of this is the unique tractor bolt illustrated above . . . produced by the Buffalo Bolt Company.

Circle Ⓑ nuts and bolts are noted for their uniform size and strength. No matter what your requirements, the controlled quality of all Circle Ⓑ products, standard or special, will enable you to improve your production efficiency and the stamina and reliability of the equipment you produce and sell.

Did you know that Buffalo Bolt Company has designed and built many highly efficient nut and bolt making machines, one of which is illustrated.

Ⓑ **BUFFALO BOLT COMPANY**

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Export Sales Office: Buffalo International Corp., 50 Church Street, New York City

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A broach performing satisfactorily right *now* can often be redesigned to increase production, improve finish and eliminate operations.

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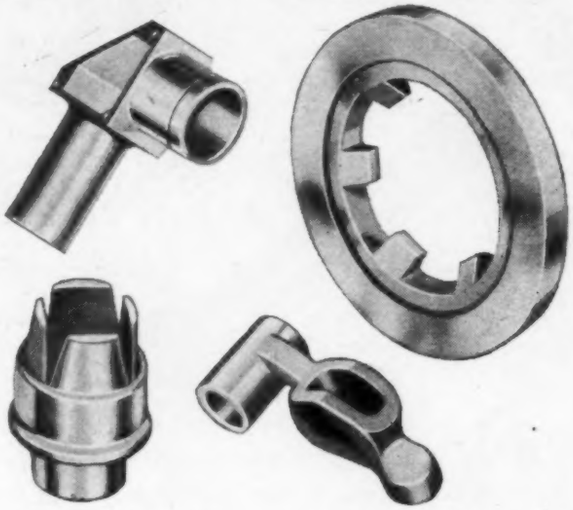

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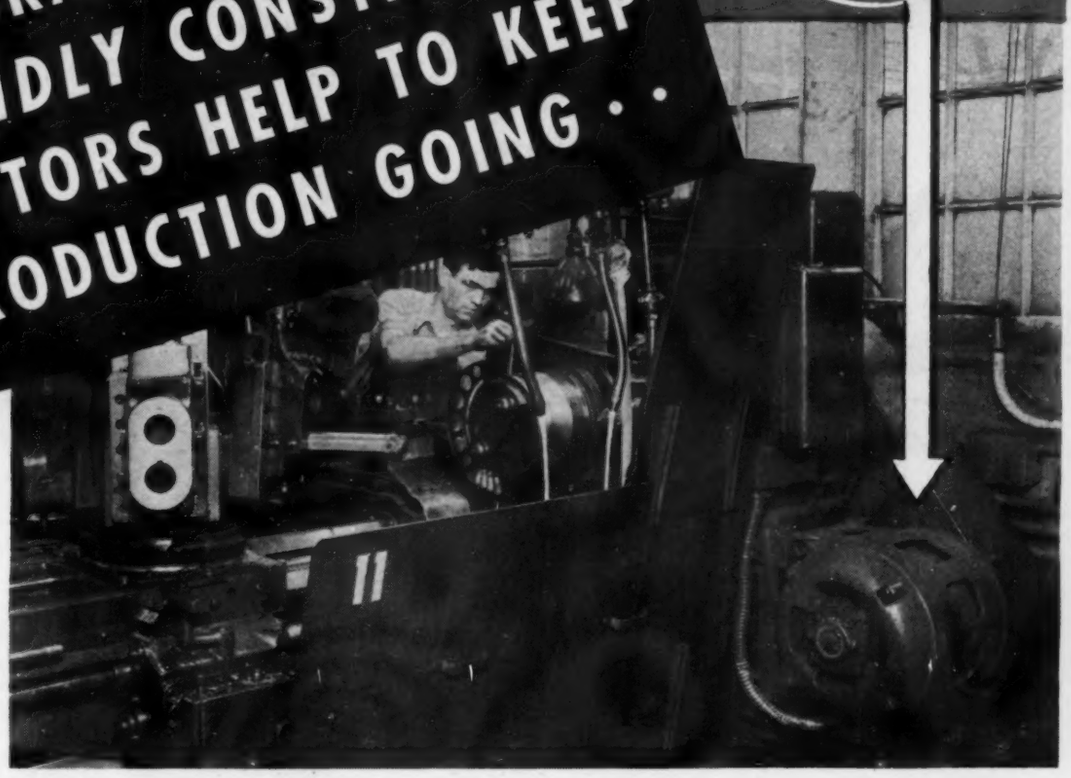
WHEN PARTS MUST BE ACCURATE—CENTURY RIGIDLY CONSTRUCTED MOTORS HELP TO KEEP PRODUCTION GOING . .



25 horsepower Century Squirrel Cage motor operates a turret lathe producing accurate machine parts.

Century motors produce the smooth power needed for highest precision work — they are built with accurate mechanical and electrical balance, permanent alignment, accurately machined mounting feet. And, all parts are housed in a rugged frame that holds all parts rigidly in place, so that top performance is assured throughout a long motor life — even under the toughest operating conditions.

Century builds a complete line of electric motors and generators, fractional and integral horsepower, in the popular sizes to meet the requirements of industrial production, processing, commercial and home needs.

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CENTURY ELECTRIC COMPANY

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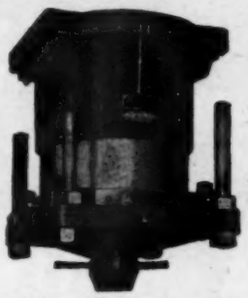

No matter how you figure it Dayton Rogers Die Cushions will assure better results and lower production costs on your punch press operations because:

1. They are readily adapted to either short run quantity requirements or for large quantity production.
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3. Correct pressure pad control on forming dies obtained quickly by simply adjusting the pressure regulator.
4. They afford positive stripping action on all compound, blanking and piercing dies.

Write for illustrated, engineering catalog #100-1

DAYTON ROGERS
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MINNEAPOLIS 7, MINN.

THE START OF A . . .
GOOD COOLANT SYSTEM

Photos Courtesy
The Taft-Peirce Mfg. Co.
Woonsocket, R. I.
Hardinge Bros., Inc.
Elmira, N. Y.

Model TL-7320

RUTHMAN GUSHER COOLANT PUMPS

The efficiency of any coolant system depends entirely on the efficiency of the Pump that controls it. Here Ruthman Gusher Coolant Pumps are outstanding. Split second coolant control, long trouble-free life, and vibrationless rigidity are among the outstanding qualities that have made Gusher Pumps preferred by the leading machine tool manufacturers.

Illustrated above left is a *Model 1-P3 Long Gusher Coolant Pump* on a *Taft-Peirce #6 Rotary Surface Grinder.* To the right is a *Model 1-P3 Short Gusher Coolant Pump* on a *Hardinge DSM59 H.S. Precision Second Operation Machine.*

Write for Catalog 10-A

THE RUTHMAN MACHINERY CO.
1809 Reading Road Cincinnati, Ohio

FREE LITERATURE

New Catalogs, Booklets, Bulletins

(Not good after June 1, 1947)

MACHINES AND ATTACHMENTS

1 AUTOMATIC MACHINES — National Automatic Tool Co., Inc., Richmond, Ind. 28-page bulletin 145-20 describes and illustrates Natco Holeway machines, which perform multiple operations including drilling, tapping and boring.

2 RADIAL CUTTING—Franklin Machine Co., East Providence, R. I. 12-page bulletin covers Wilson radial-cutting machine, which has applications in the metalworking field for operations on light metal.

3 FOUNDRY MACHINES — Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. 20-page bulletin 07B6092A "Foundry Mechanization" describes shakeouts, cleaning machines, sand conditioners and reclaimers, blowers, motors, drives and controls.

4 CENTER DRILLING—Detroit Tap & Tool Co., Detroit 11, Mich. 4-page bulletin DCD-1 describes center-drilling machine which drills concentric centers in stock prior to subsequent machining operations.

5 BANDSAW — Machine Tool Div., Kalamazoo Tank & Silo Co., Kalamazoo, Mich. 8-page bulletin 47 describes and illustrates metal-cutting bandsaw with an 8-in. throat and a 16-in. vise for flat work.

6 SPEED LATHE — Crosier Machine Tool Co., Hawthorne, Cal. 12-page catalog 46-1 covers Vacuum-Grip speed lathe for odd-shaped parts that cannot be held by chuck or collet. It describes a collet-closing attachment and toolpost turrets.

7 RADIUS ATTACHMENT — Accreylon Co., Inc., New York 18, N. Y. 8-page booklet describes radius attachment made by Manchester Repetition Engineers Ltd. It can be used on machines including lathes, grinders, and milling machines for jobs such as radius grinding and milling.

8 HORIZONTAL MACHINE — The G. A. Gray Co., Cincinnati 7, Ohio. 8-page bulletin 54 covers planer-type horizontal boring, drillingand milling machine which has electronic drive for all feeds.

TOOLS AND ACCESSORIES

9 CUTTING TOOLS, DIES — Jessop Steel Co., Washington, Pa. 20-page catalog covers Malta carbide and T and V cast-alloy tools, toolbits, dies and wear-resisting parts such as lathe centers, snap and thread gages and lathe rests.

10 CUTTERS — Kearney & Trecker Corp., Milwaukee 14, Wis. 20-page catalog C-11 describes and illustraes CSM face-milling cutters, replacement parts and accessories with information on selection and care.

11 PROFILE GAGES — Zina Goodell Corp., Salem, Mass. Folder describes line of profile gages. They are made of laminations which adapt themselves to curves or angles on the surface to be measured.

12 TAPS—Hy-Pro Tool Co., New Bedford, Mass. Folder describes commercial, precision and special ground-thread taps. Miniature toolboxes are provided for ¼-in. dia. taps or smaller when in lots of 3 or 12.

13 TOOL-DRESSING FIXTURE — Allied Machinists of Waltham, Waltham, Mass. 4-page bulletin describes Gem-Flex wheel and tool-dressing fixture. It can be used as a flexible indicator stand, a surface gage and for handling drilling and light milling work.

14 FACE MILL—Lovejoy Tool Co., Inc., Springfield, Vt. 8-page bulletin describes "Cutsall" Carboloy-tipped toolbit-type face-milling cutter. It is available in 6-, 8-, 10- and 12-in. dia.

15 CHUCKS — Westcott Chuck Co., Oneida, N. Y. 12-page catalog 700 covers independent, universal, combination and light-duty chucks. Includes price and parts lists.

16 METAL MARKING—The Noble & Westbrook Mfg. Co., East Hartford 8, Conn. 30-page catalog 47 describes and illustrates Noblewest marking machines, presses, dies, stamps, type and type holders.

HEAT-TREATING AND WELDING

17 CALCULATOR—Bliss & Laughlin, Inc., Harvey, Ill. Steel "Datalator" gives chemical composition, physical properties, furnace treatment and machining data, and hardness-conversion and carburizing-treatment data on carbon and alloy steels.

18 TEMPERATURE CONTROL — Wheelco Instruments Co., Chicago 7, Ill. 20-page bulletin 5 describes automatic temperature-control systems. Charts, tables and diagrams explain measurement, control and selection of systems.

19 PYROMETERS—Leeds & Northrup Co., Philadelphia 44, Pa. 16-page catalog ND46(1) covers Speedomax type G pyrometers with information on characteristics, maintenance, installation and accessories.

20 TEMPERATURE REGULATORS—Lealie Co., Lyndhurst, N. J. 24-page bulletin 464 gives installation, operation and maintenance data on temperature regulators and controllers. Includes capacity tables.

21 WELDERS — Westinghouse Electric Corp., Pittsburgh 30, Pa. Booklet B-3548 describes line of ac. transformer-type welders. Includes construction details, specifications and application data.

22 WELDING AND CUTTING—Wall Chemicals Div., The Liquid Carbonic Corp., Chicago 7, Ill. Catalog describes Gasweld welding and cutting equipment and supplies, such as cutting torches and welding and cutting outfits.

23 STUD WELDING—Nelson Sales Co., Lorain, Ohio. 36-page catalog describes automatic stud-welding process, illustrating equipment and studs. Gives information on properties, specifications and applications.

24 PYROMETER—Illinois Testing Laboratories, Inc., Chicago 10, Ill. 6-page bulletin 3511-C describes Alnor "Pyrocon" contact pyrometers for flat- or curved-, moving- or stationary-surface temperatures.

25 ELECTRODES—Alloy Rods Co., York, Pa. 40-page catalog 46-RS covers entire line of alloy electrodes. It gives data on subjects such as welding procedure, physical properties, metallurgy, and deposit characteristics.

Example

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PLANT SERVICE EQUIPMENT

26 INDUSTRIAL TRUCKS — Clark Tructractor Div. Clark Equipment Co., Battle Creek, Mich. 36-page catalog describes battery-powered trucks, towing tractors and fork trucks. Includes attachments including the new "Pul-Pac" device.

27 FLOOR TRUCKS—Nutting Truck & Caster Co., Faribault, Minn. 12-page bulletin 47G describes two-wheel, dolly, wagon, bar-handle, stake and rack, enclosed and other trucks. Also covers casters and jack-skids.

28 DEGREASERS—Mechanical Process Co., South Orange, N. J. 8-page bulletin describes and illustrates "D'Oiler" degreasers including bench-type, barrel-type, two- and three-dip, automatic and semi-automatic degreasers.

29 POWER TRUCK—Automatic Transportation Co., Div. Yale and Towne Mfg. Co., Chicago 20, Ill. 6-page bulletin 1003 describes automatic push-pull Transtractor, a towing-type unit with controls in the steering handle.

30 SPRAY BOOTHS — Peters-Dalton, Inc., Detroit 12, Mich. 16-page bulletin describes and illustrates Hydro-Whil wet-type spray booths which wash polluted air by a new principle.

31 LIFT TRUCKS—The Ross Carrier Co., Benton Harbor, Mich. Four bulletins describe models 12-HT, 16-HT, 19-HT and Series 5 lift trucks. The latter incorporates an "unlimited visibility" principle.

32 UNIT LOADS—The Electric Industrial Truck Association, Chicago 4, Ill. 16-page booklet "Unit Loads" describes unit-load method of handling material in plants, carloading and warehouses. Includes case studies.

33 MANAGEMENT CONTROL—Systems Div., Remington Rand, Inc., New York 10, N. Y. 32-page booklet describes Sched-U-Graph, a chart-board application of time-control principles. It can be applied to operations such as scheduling of production and sales progress.

34 LIFT TRUCK—Lewis-Shepard Products, Inc., Watertown 72, Mass. 8-page bulletin describes power Jacklift which comes with 2- or 3-ton capacity. Controls are in the handle head.

35 COMPUTER—S. G. Taylor Chain Co., Hammond, Ind. Computer to determine the maximum safe load that can be lifted by a sling chain at any given angle. It is printed on plastic for easy reading.

36 TRACTORS—W. F. Hebard & Co., Chicago 9, Ill. Three bulletins describe J233 heavy-duty, A3V-U2 Materials Expediter, and A14V medium-heavy-duty Shop Mule tractors.

37 CONSTRUCTION DATA — A. C. Horn Co., Inc., Long Island City 1, N. Y. 96-page reference book, "Construction Data and Hand Book" covers products such as flowing materials, and exterior and interior coatings.

PARTS AND MATERIALS

38 COLOR DYNAMICS — Pittsburgh Plate Glass Co., Pittsburgh 19, Pa. 32-page booklet describes and illustrates applications of color dynamics to improve efficiency, continuity of employment and production quality.

39 COUPLINGS — Industrial Machine Works, Inc., South Hanover, Mass. 4-page bulletin describes gear-tooth flexible couplings designed to provide simultaneous automatic correction for angular and parallel misalignment.

40 CLUTCHES — Brown Engineering Co., Reading, Pa. Series of bulletins describes Mule-Pull clutches, ring-oiling bushings, Jackson time-saving vise and sectional stock racks.

41 TOOL STEELS—Hoyland Steel Co. Inc., New York 17, N. Y. 74-page catalog covers tool steels with information on heat treating and working. Includes hardness- and temperature-conversion tables and a glossary of steel industry terms.

42 PROTECTIVE COATING — Industrial Metal Protectives, Inc., Dayton 2, Ohio. 20-page bulletin describes properties and illustrates applications of "Zincilate" self-protecting coating.

43 LABORATORY APPARATUS — Central Scientific Co., Chicago 13, Ill. 26-page bulletin 76A describes "Cenco" metallurgical laboratory apparatus including Photolometers, specimen grinders, hardness testers and furnaces.

44 CUTTING OILS—Machinery Lubricants, Inc., Boston 16, Mass. Two 4-page bulletins describe Velva Kut cutting-oil base and Silver Chip non-petroleum cutting and grinding compound.

45 SPEED REDUCER — The Flinn & Linbaugh Co., York, Pa. 4-page bulletin describes Men-E-Uses variable-speed power drive which reduces 1725 rpm. speed to a range from 4 to 750 rpm.

46 FASTENERS — Camloc Fastener Corp., New York 17, N. Y. 8-page bulletin 46A covers quick-acting fasteners composed of stud assembly and receptacle.

47 INSULATING VARNISHES — Chemical Dept., General Electric Co., Pittsfield Mass. 40-page booklet gives technical and application data on GE insulating varnishes. It describes 36 grades.

48 BALL BEARINGS — Dodge Mfg. Corp., Mishawaka, Ind. 20-page bulletin A-120 describes line of SC ball bearings. Gives information on pillow blocks, hanger bearings and other units. Includes selection tables.

49 FLEXIBLE SHAFTING — Walker-Turner Co., Inc., Plainfield, N. J. 20-page bulletin describes flexible shafting, giving design and engineering data and applications.

50 COUPLINGS — The Falk Corporation, Milwaukee 8, Wis. 32-page bulletin 4100 covers Steelflex couplings. Contains selection tables for motor and turbine applications.

51 PLASTICS TABLE—Shaw Insulator Co., Irvington 11, N. J. Table lists general properties and uses of molded plastics. Typical applications serve as a guide to material selection.

52 VARIABLE SPEED CONTROL — Reeves Pulley Co., Columbus, Ind. 12-page folder describes V-belt variable-speed transmission. Sizes are to 87 hp. Speed ratios are from 2:1 to 16:1. Also describes Vari-Speed Motodrive, Motor Pulley, and controls and applications.

53 CONTROL VALVES—The Foxboro Co., Foxboro, Mass. 36-page bulletin "Pneumatic Control Valves and Controller Accessories" contains identifying-color system of Stabilflo valves, specifications for control valves, an appendix for computing sizes for installations, and descriptions of other valves and accessories.

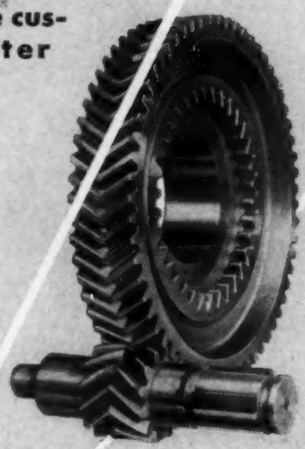
54 PLASTIC TERMS—B. F. Goodrich Chemical Co., Cleveland 15, Ohio. 12-page glossary of chemical names, terms and phrases used in plastic and rubber industries.

55 CUTTING-TOOL MATERIALS — Allegheny Ludlum Steel Corp., Pittsburgh, Pa. 34-page booklet analyzes comparative fields of usefulness of high-speed steel, cast alloys and carbides as cutting tools. It correlates characteristics, properties and functions and makes recommendations for proper selection.

56 PACKAGING MATERIALS — Protective Coatings Corp., Belleville 9, N. J. 16-page brochure on various materials for protection of products in transit or storage. Describes, among others, waterproof coating and peelable plastic coating. Charts and illustrations cover physical characteristics and procedures.

BACKBONE comes in a wide range of GEAR SIZES

You can get the power transmitting advantages of *backbone* in Farrel gears from 1/4 inch to 20 feet in diameter, 1/4 inch to 60 inch face, 24 DP to 0.75 DP. Made in a complete range of sizes for any power capacity, these continuous tooth, herringbone gears are known in industry as the *Gear with a Backbone*. Instead of the customary center groove, Farrel double helical gears have a *backbone* formed where the helices meet in sharp V's to make the teeth continuous. This puts the entire face width to work and gives extra strength and load-carrying capacity to gears of any size.



Farrel can also supply straight tooth (spur) gears, single helical gears and internal gears in a wide range of sizes, with the teeth accurately generated by Farrel-Sykes gear generators.

When you need gears or gear engineering help, call on Farrel. For general information, write for catalog No. 438.

FB-372

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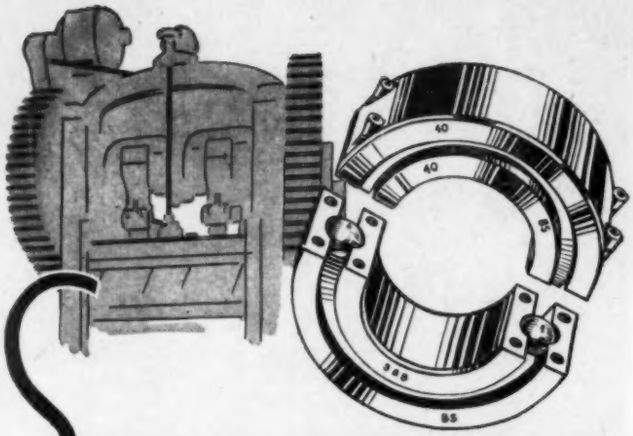

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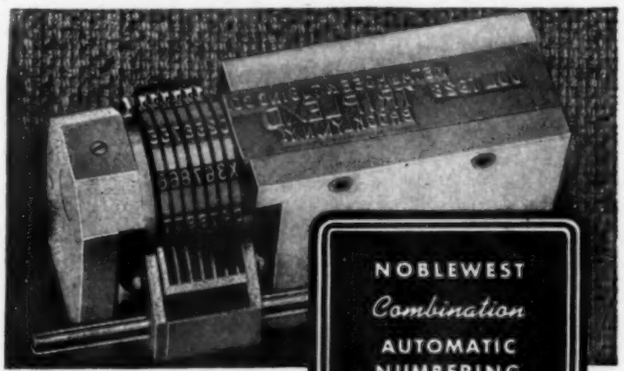

There's practically no limit to combinations for marking and consecutive numbering that Noblewest can supply. Model 131, above, shows a Noblewest automatic numbering head combined in one marking tool with an interchangeable flat marking die. All Noblewest marking tools are of the very finest quality. Write Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

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INTERNAL GROOVING TOOL

Its versatility saves costly preparation time—provides precision grooving of single or multiple grooves at a production rate—plus economy of set-up time—and low initial cost. The LYON has been designed for making internal grooves to tolerances of .001" using any drill press, turret lathe, radial drill or automatic equipment.

By changing only bushings and cutters within the tool model range, you have at your command a wide variety of bore sizes and shapes. A simple adjustment regulates location and depth of groove. Work cannot be scratched or marred because the head of the tool does not turn when the cutter operates.

Our Engineering Department will welcome the opportunity of discussing any grooving problem without obligation.

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1629 & 1947

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The production of custom-cut gears has been our business for over 25 years. Our gear engineering know-how is backed up by facilities which ensure a steady flow of gears to meet *your* production schedules without interruption.

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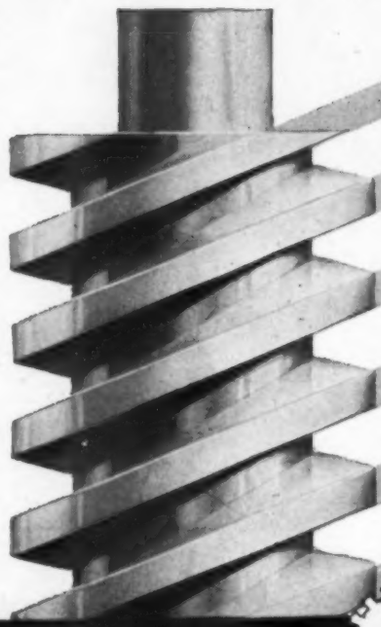

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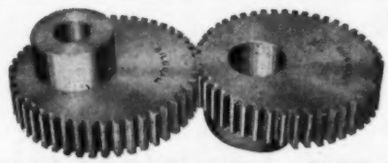

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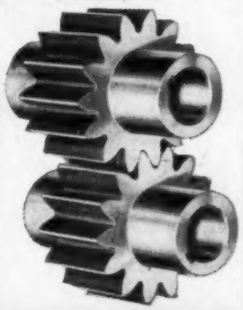
To provide the maximum in gear efficiency CINCINNATI GEARS, where needed, are ground, shaved or lapped. We can shave from 1" to 24" pitch diameter. To eliminate distortion after hardening, high-speed precision gears can be ground to provide the required accuracy.

Look to Cincinnati GEARS, GOOD GEARS ONLY, for that extra value.



THE CINCINNATI GEAR COMPANY
"Gears... Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio

YOUR REQUIREMENTS
assured by
Our 69-Year Experience

Grant "know-how" in making and supplying gears is at your service. Whether you require a single "special" or stock gears in quantity, it will be to your advantage to submit your requirements to "Grant" for quotation and delivery date. We are in position to render prompt service.

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BOSTON, MASS.

475 Machine Tools MEANS CAPACITY PRODUCTION WITH *Brad Foote Gears*

CUT GEARS
ALL SIZES • WORM • SPUR
HELICAL • HERRINGBONE
SPIRAL • STRAIGHT BEVEL
HYPOID • ZEROL • SPIRAL BEVEL

SPEED REDUCERS
Any Ratio • All Horsepowers

RATIOS

Herringbone	2:1 to 295:1
Worm	3⅜:1 to 60:1
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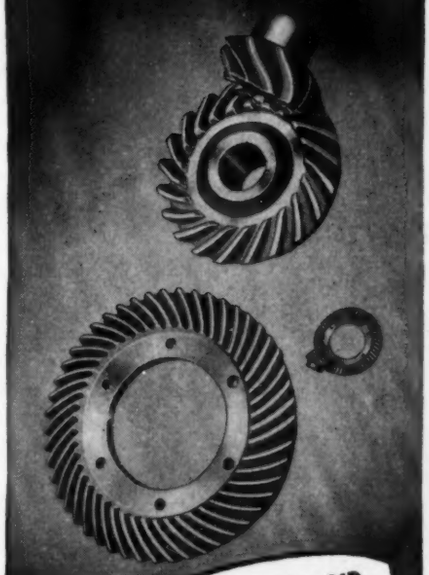

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Diameters ¾ inch and 24 Diametral Pitch—To—Approx. Diameters 32 inch and 1½ Diametral Pitch.

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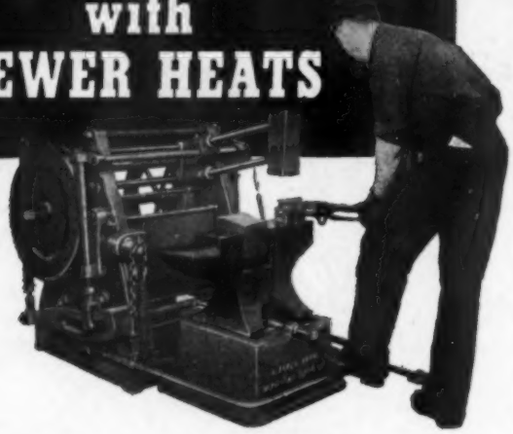


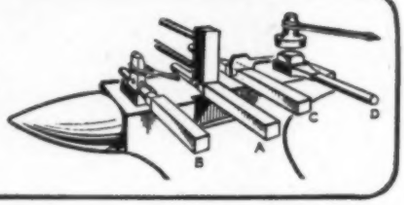
This direct-geared, electric-motor-driven power hammer replaces hand sledges.

It delivers sledge-hammer blows, light or heavy, fast or slow, exactly where and when you want them. No time lost, no confusion.

Result—more operations per heat.

The McKiernan-Terry Blacker Hammer is operated by the smith alone, without human helpers.

His foot on the starting treadle controls weight and speed of hammer blows. Both hands left free for work on the anvil, using familiar hand tools and methods.



Four consecutive bolt-making operations with the Blacker Hammer. A—Double-shouldering. B—Swaging. C—Cut-off. D—Heading.

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Shows how this "mechanical helper" saves blacksmith's time, reduces costs, increases anvil capacity and shop output. Diagrams. Specifications. Just send the coupon.

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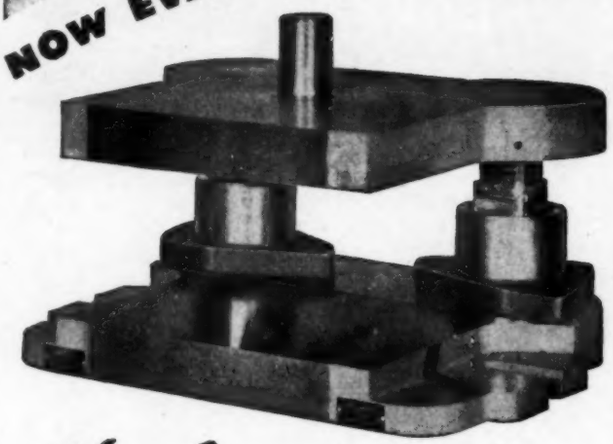

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Now Evans offers you the perfect companion pieces for expensive tools and dies. They are Microlex Anti-Friction Die Sets.

Microlex Die Sets have ball or roller bearing guide pins. As a result they make it possible for you to produce parts faster, to tighter limits of accuracy and reduce scrap loss.

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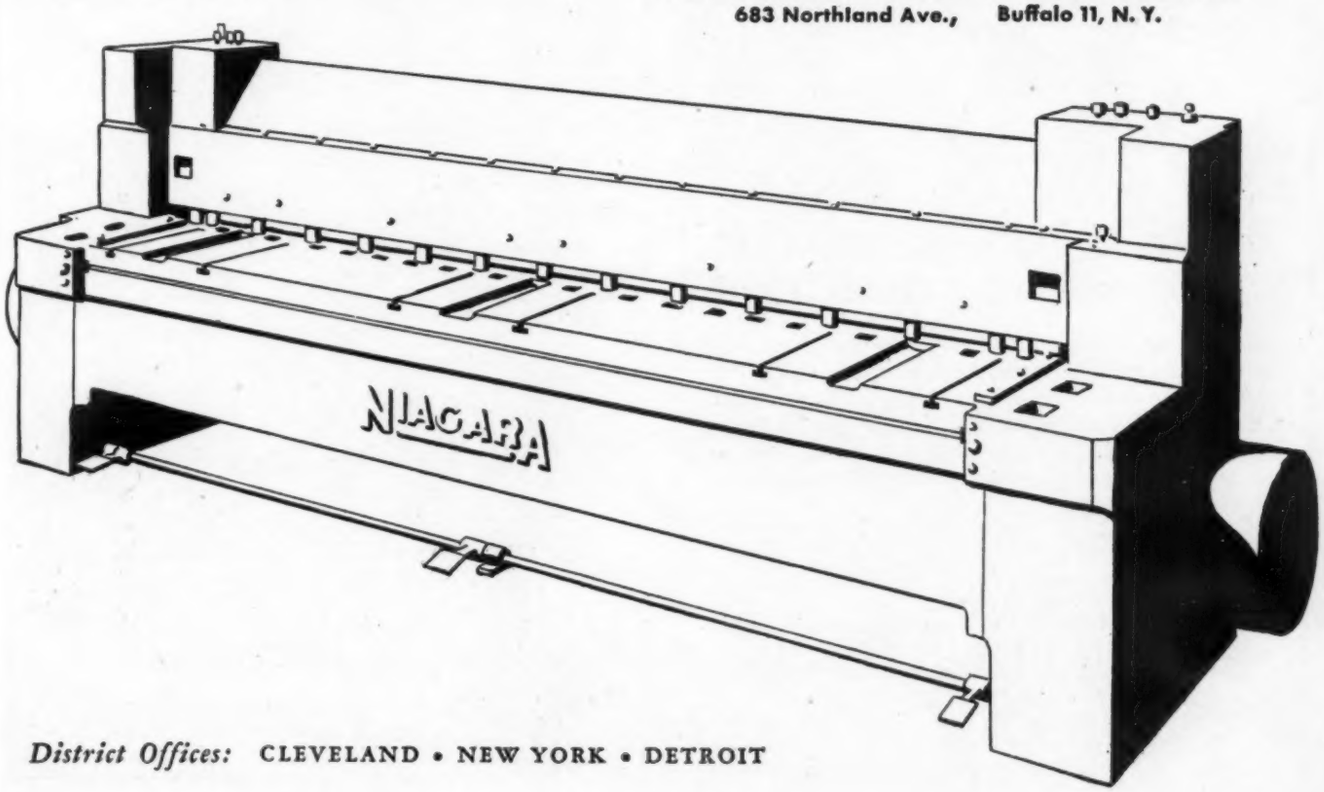

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No. 1G	INTERNAL GRINDER	No. 34	VERTICAL SPINDLE SURFACE GRINDER
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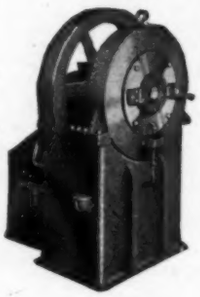

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Our line might be a shade different from the country doctor's but it surely parallels his. For 40 years we've been prescribing the right machine tools, and we'd appreciate this opportunity to help you. No job is too big for us to handle, or too small to receive our closest attention. Call on us any time.

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STRAIGHT SIDE SINGLE CRANK PRESSES

for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

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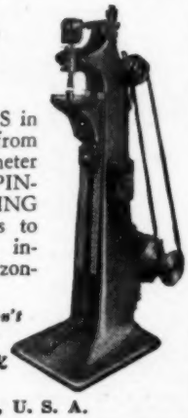
Write for literature and don't forget to send samples.



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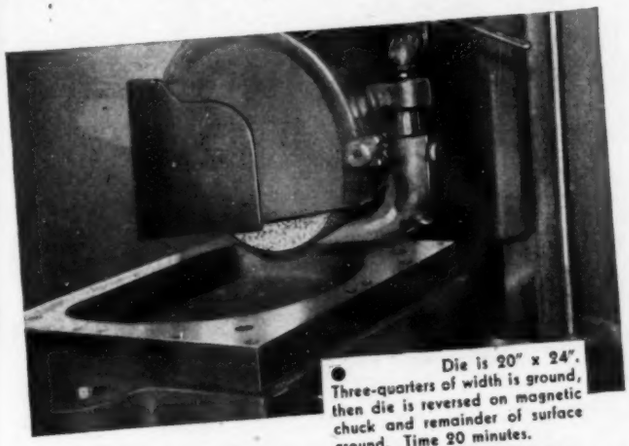
'TIME OUT' FOR DIE RECONDITIONING HELD TO A MINIMUM *with the* *Mattison Grinder*

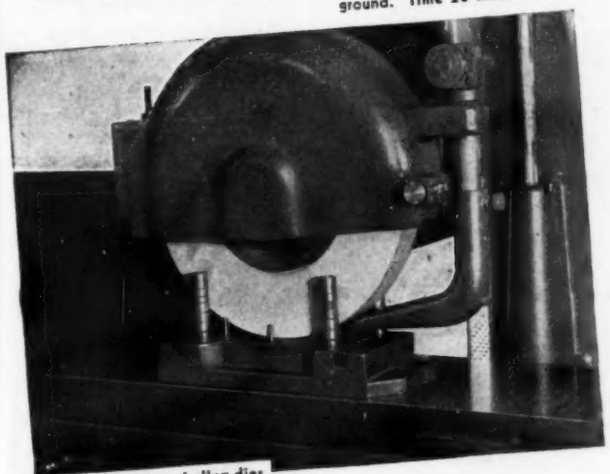
A GREAT variety of die work can be speedily and easily handled on the Mattison Surface Grinder. Its large capacity, ability to hog off stock and high power, keeps the 'time out' periods to a minimum.

A few examples of die jobs ground on the Mattison at a considerable saving in time, are shown on this page. Die shown in the lower left hand corner was ground with leader pins in place at ⅓ of former time. Wheel and spindle clearance of Mattison Grinder is sufficient to handle this type of work with ease, eliminating time required for disassembly and alignment when leader pins are removed.

For further data regarding use of Mattison Grinders for reconditioning dies, ask us to send you free set-up book on this subject.

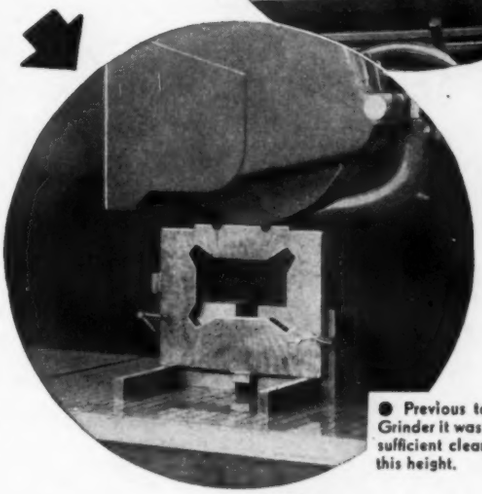


● Die is 20" x 24". Three-quarters of width is ground, then die is reversed on magnetic chuck and remainder of surface ground. Time 20 minutes.

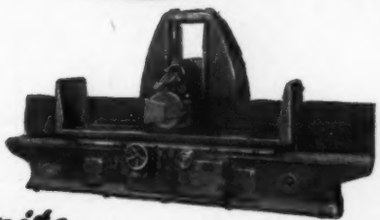


● Time is saved by grinding dies with leader pins in place.

● Material: Hardtem Steel Forging die.
Stock Removed: $\frac{1}{64}$" from face side.
Present Time: 8 minutes.
Previous Time: 30 minutes.



● Previous to obtaining Mattison Grinder it was not possible to obtain sufficient clearance to grind dies of this height.



Write for Free Set-up Book containing further examples, showing how others have reduced time and cut costs with Mattison Grinders.

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. . . A "REVOLUTION" IN MACHINING INDUSTRY . . .

TOUGH Threading jobs licked by COULTER TYPE "H" THREAD TAP MILLING MACHINE

NOW . . . comes a development that extends the capacity of this 'wonder' machine. COULTERS' are made to perform the most delicate threading operation with both speed and accuracy . . . 40 years of specialized experience, manufacturing precision machines exclusively. The NEW Type "H" is equipped with *an overarm tail center and large collet chuck*, holding the work rigidly so *ONLY ONE REVOLUTION OF THE TAP* is necessary.

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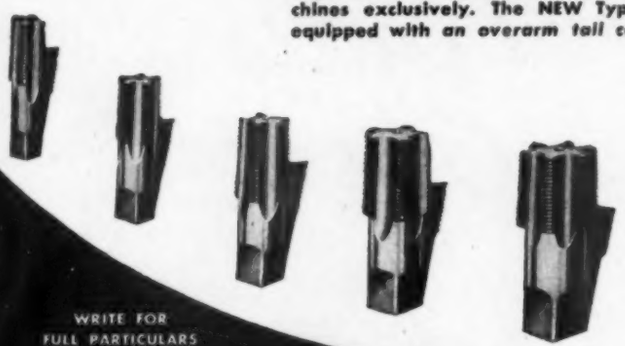

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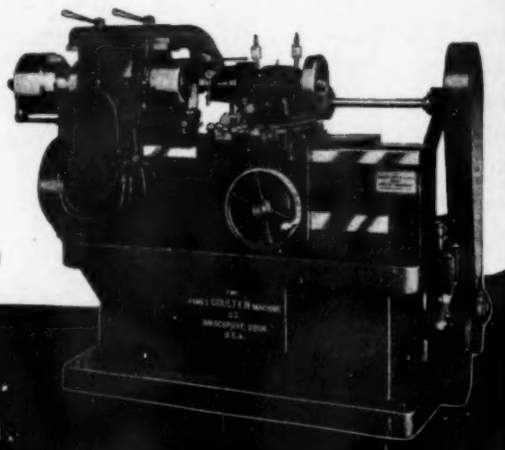

TYPE H

The James **COULTER** *Machine Co.*

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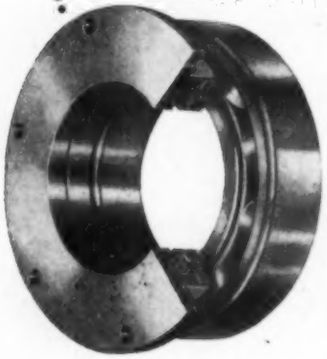
HIGH SPEED OIL SEALS

are Custom-Built for Extra Satisfaction

FLANGED or PRESS-FIT STYLES for VERTICAL or HORIZONTAL APPLICATIONS



- Highly-finished specially tensioned Bronze Contact Face.
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- Steel Springs give properly even pressure distribution.
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BAUMBACH *The* **DIE SET AUTHORITY**

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

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FEEDS
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***Available for* IMMEDIATE DELIVERY**

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for speed, accuracy and economy

These convenient, high speed, power presses will handle materials with ease and convenience. Assures high production of parts at lowest cost.

Made in 4½, 6, 15 and 27 ton capacities

Inquire about the new 27 ton machine.

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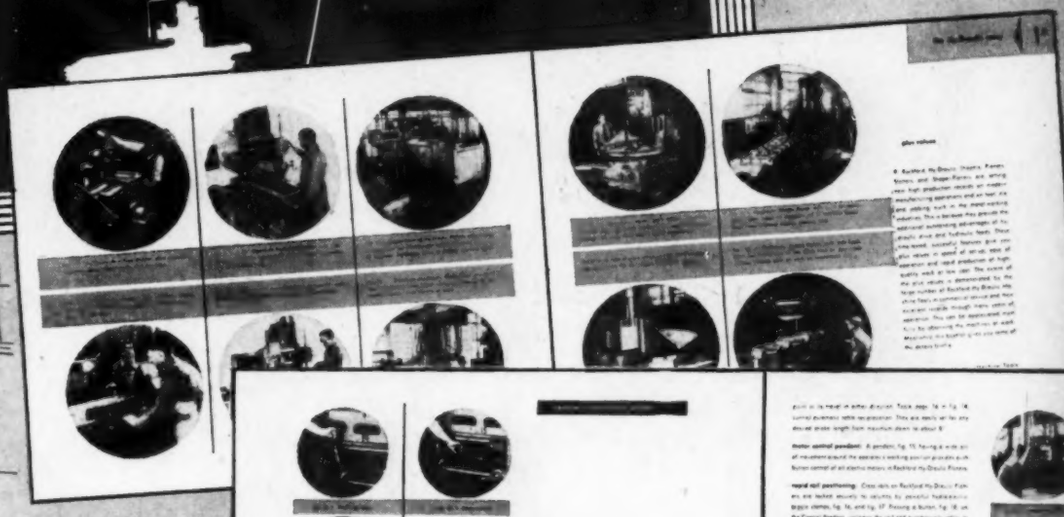
Rockford Machine Tool Co.

for the production engineer . . . or the company executive who selects and buys machine tools



for the plant superintendent . . . or the shop executive responsible for machine tool selection and performance

if you want the facts . . . write for this new catalog

Every essential fact about design, application, and performance is condensed in this new 32 page catalog . . . the complete up-to-date story about Rockford Hy-Draulic Shapers, Planers, Slotters, and Shaper-Planers. Write for your copy . . . see for yourself the many advantages modern Rockford Hy-Draulic machine tools provide.

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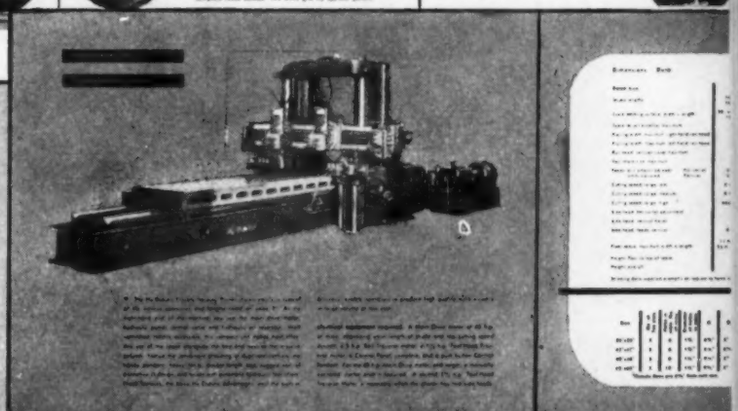

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Hy-Draulic

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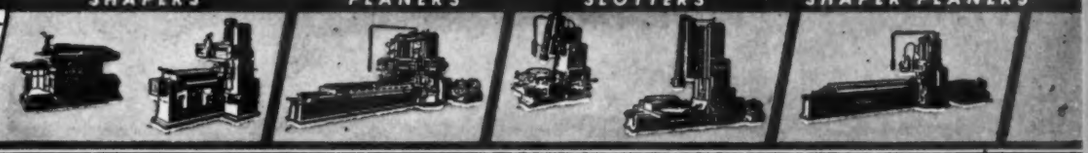
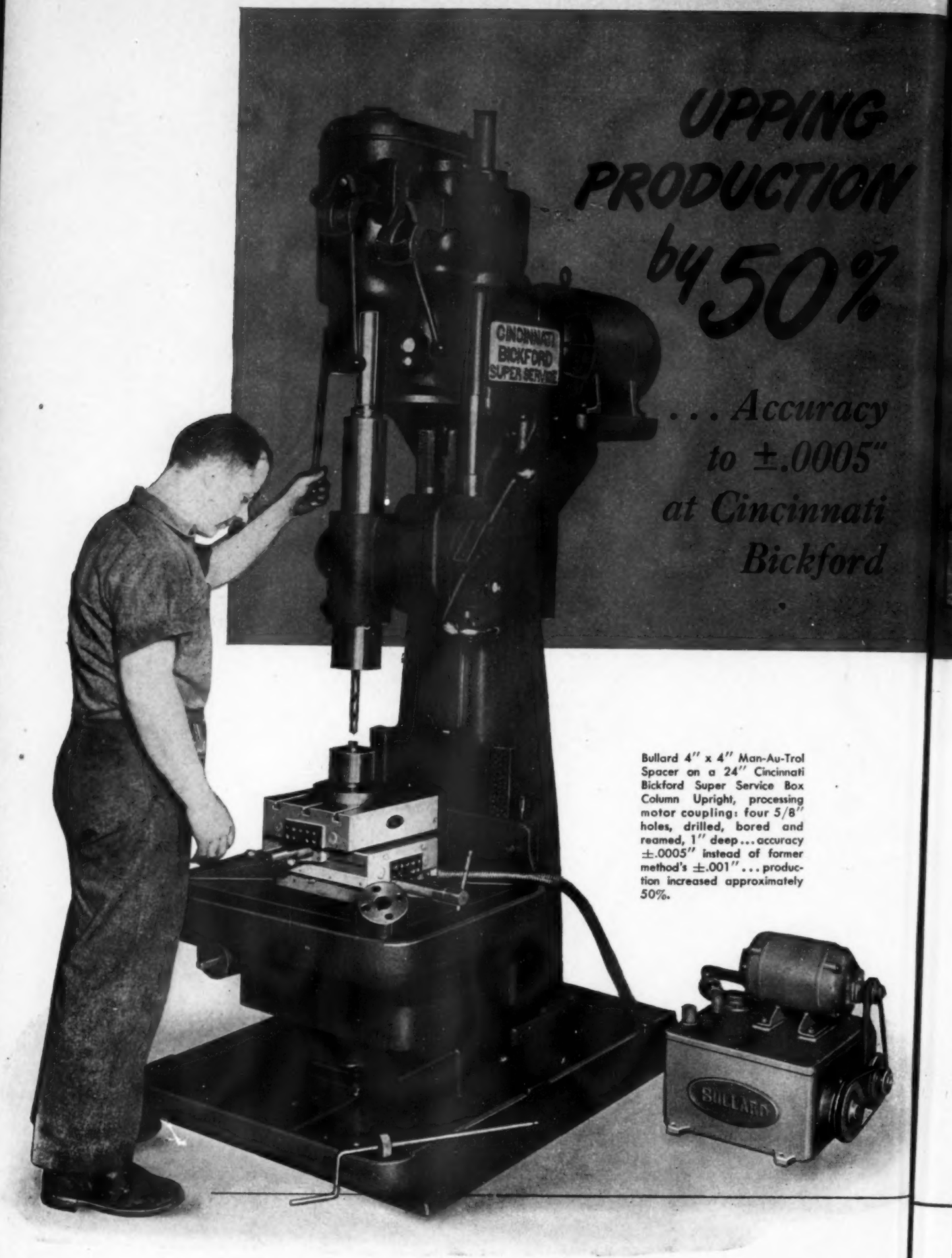
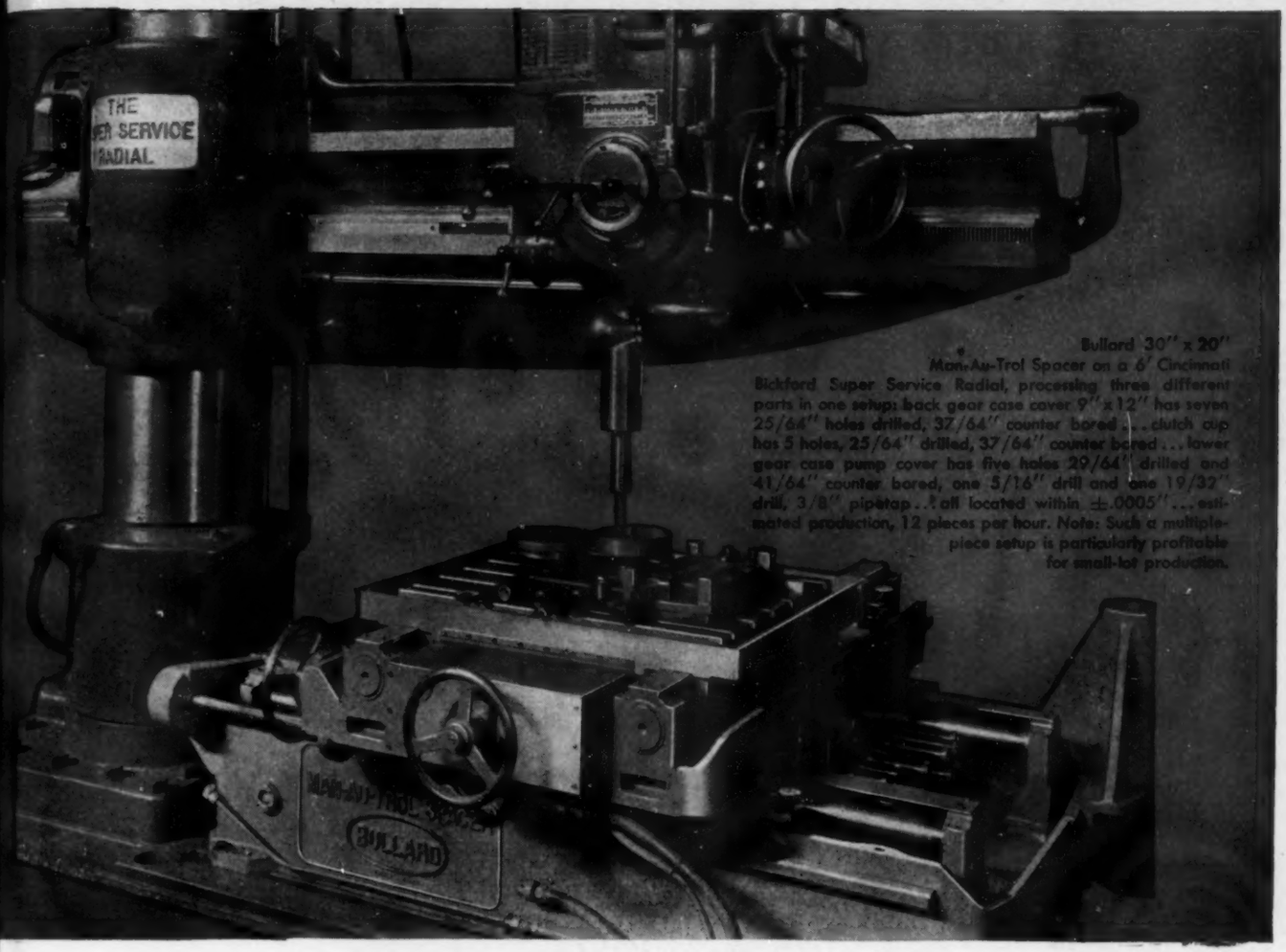




Bullard 4" x 4" Man-Au-Trol Spacer on a 24" Cincinnati Bickford Super Service Box Column Upright, processing motor coupling: four 5/8" holes, drilled, bored and reamed, 1" deep... accuracy ±.0005" instead of former method's ±.001"... production increased approximately 50%.



Bullard 30" x 20" Man-Au-Trol Spacer on a 6' Cincinnati Bickford Super Service Radial, processing three different parts in one setup: back gear case cover 9" x 12" has seven 25/64" holes drilled, 37/64" counter bored . . . clutch cup has 5 holes, 25/64" drilled, 37/64" counter bored . . . lower gear case pump cover has five holes 29/64" drilled and 41/64" counter bored, one 5/16" drill and one 19/32" drill, 3/8" pipetap . . . all located within ±.0005" . . . estimated production, 12 pieces per hour. Note: Such a multiple-piece setup is particularly profitable for small-lot production.

New Bullard Man-Au-Trol Spacers Eliminate Hole-Locating Jigs and Fixtures

Bullard MAN-AU-TROL Spacers now on the production line are more than living up to their advance notices. Machines and men formerly tied up on the non-productive work of making hole-locating jigs are now doing the kind of productive work that cuts operating overhead, develops competitive price advantages and steps up profit. Drilling, boring, reaming and tapping volume and accuracy are reaching new peaks . . . while operators' fatigue is measurably reduced.

To bring yourself up to date on this revolutionary new hole-locating method, write for the MAN-AU-TROL Spacer Bulletin. The Bullard Company, Bridgeport 2, Connecticut.

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CREATES *NEW METHODS*

TO MAKE MACHINES DO MORE

NEW *Single-Unit Motor-Driven* 20" ROTARY TABLE

- Eliminates all set-up time.
- May be used on any make of milling machine or horizontal boring mill.
- Plug it into the nearest light socket and it's ready to go.

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MACHINERY COMPANY

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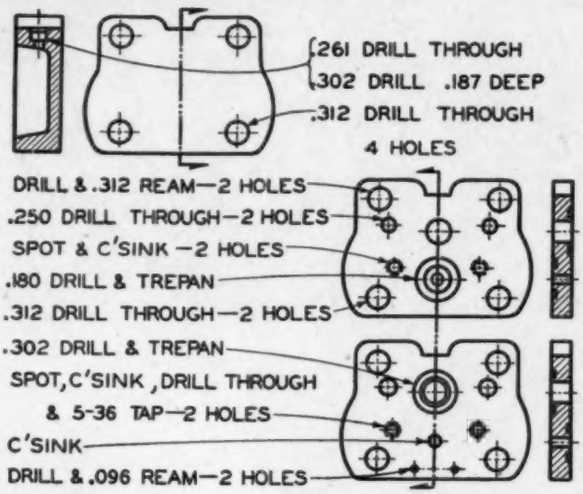
MORE GOODS for MORE PEOPLE at LOWER COST

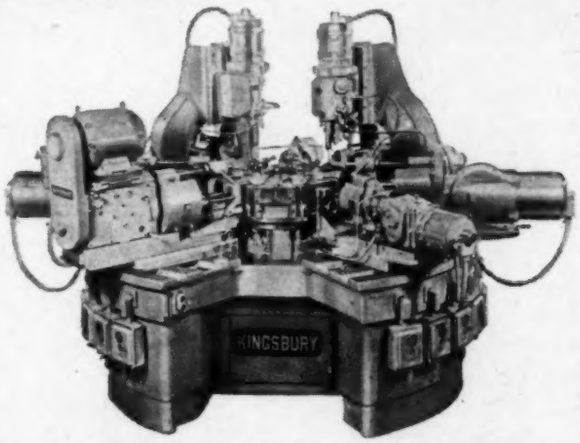
3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

Multiple Drilling for High Production

Problem Machine cast iron cylinder heads (left) and opposite faces of valve plates (right)

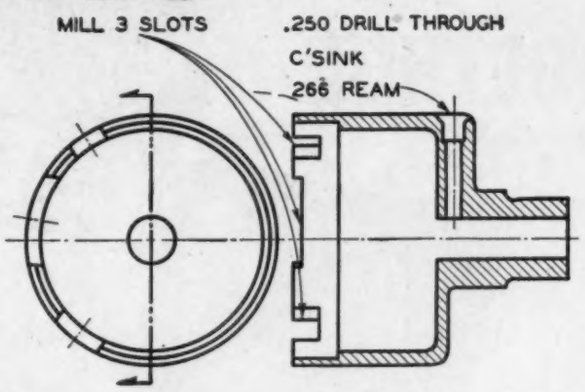


Method ONE 27 SPINDLE AUTOMATIC indexing machine with eight duplicate fixtures performs the operations on either part. Each valve plate is completed in two chuckings. Accuracy is insured by locating the plate in the second chucking from holes reamed in the first.

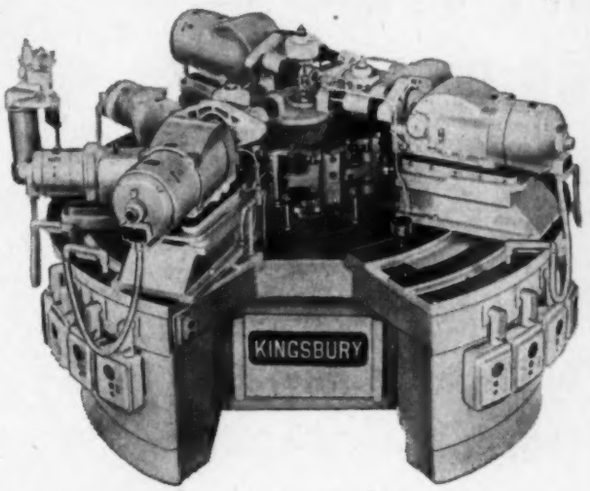


Results 400 PIECES PER HOUR GROSS with one operator, economies in handling, floor space and quality control. These savings reduce the unit cost enough to pay for the machine in a short time.

Problem Machine cast iron distributor bases as shown



Method MILLING AND DRILLING OPERATIONS are combined on this seven-spindle automatic indexing machine. Three of the seven standard drilling units have standard milling attachments. The long hole is drilled in three steps to reduce the time cycle.



Results 480 PIECES PER HOUR GROSS with one operator

If you have high production work involving multiple drilling operations requiring up to 5 H. P. each, we can design, build and tool automatic machinery to solve your problems. Send us your prints showing the operations and hourly production and ask for proposals.

KINGSBURY MACHINE TOOL CORP., KEENE, N. H., U. S. A.

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Avey Automatic
METHOD No.3

THE *Avey* CAM FEED UNIT

No. 1 Size—1/2" capacity in cast iron.
No. 2 Size—7/8" capacity in cast iron.

designed for simple automatic indexing (vertical application) when duplication of operation is required about a center and in the same plane

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.

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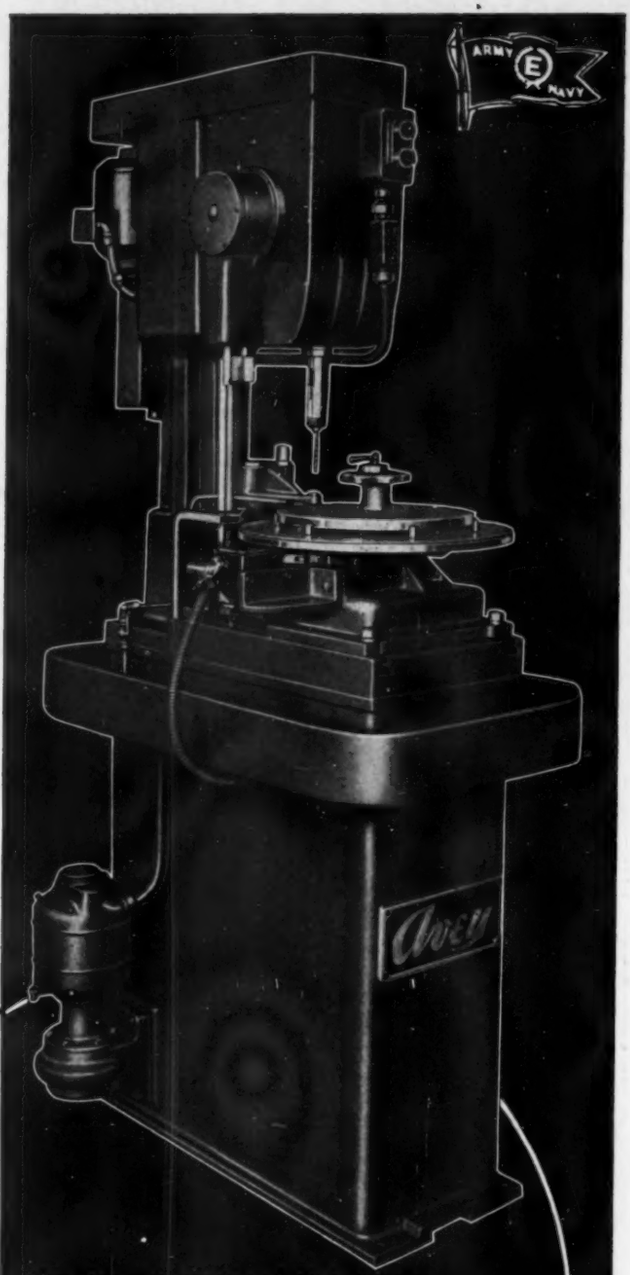

The Avey Cam Feed Unit (Avey Automatic Method No. 3)—a low capital investment, continuous operation enabling operator to devote time to another job. Decreases the cost per piece—enabling semi-skilled operators to deliver high quality production speedily, accurately, efficiently and with a minimum of supervision.

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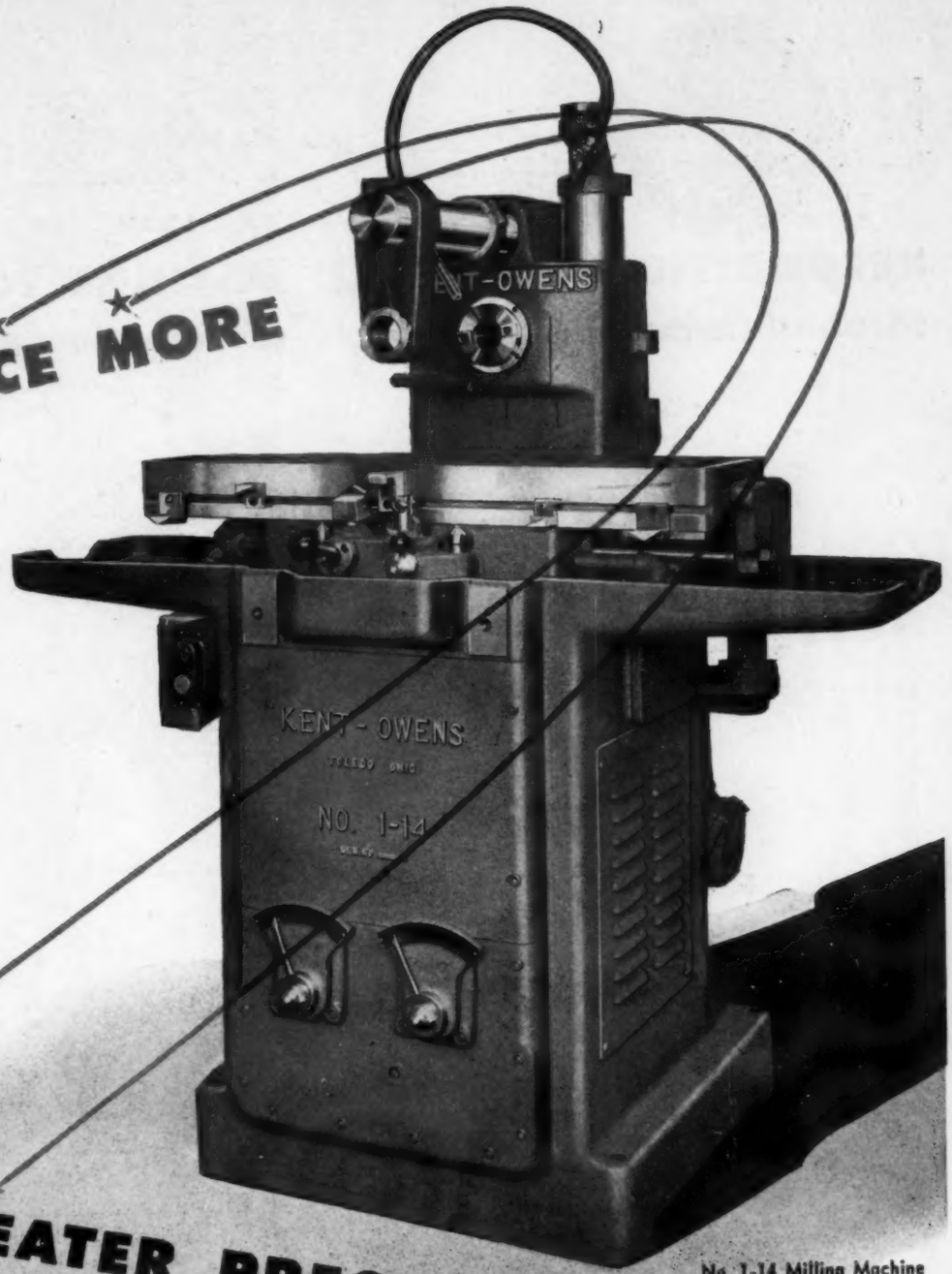
PRODUCE MORE

WITH GREATER PRECISION



No. 1-14 Milling Machine
Table, 32" x 9"
Table travel, 14"

Put the work on Kent-Owens Milling Machines for *efficient* production . . . at *top speed* . . . with *high accuracy!* These machines designed for rapid, easy set-up and operation. Rugged . . . with twin-post head mounting that assures balanced load—no chattering. Practical features throughout get the O.K. of the good machinist.

The Kent-Owens Standard line includes a wide range of hydraulic and hand operated machines. Also, Kent-Owens builds special machines for many types of work. Let a Kent-Owens engineer recommend machines and tooling best suited to your requirements. Consult us about your needs. Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS

for Milling Machines

GENERAL MACHINERY

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

RECONDITION YOUR OLD MACHINE TOOLS

to obtain maximum efficiency for meeting modern demands

We have complete records and shop facilities for repairing and servicing the following makes of machine tools.

- Bement Miles & Co., Philadelphia, Pa.
- Ridgway Machine Co., Ridgway, Pa.
- Pond Machine Tool Co., Plainfield, N. J.
- David W. Pond Co., Worcester, Mass.
- Detrick & Harvey Co., Baltimore, Md.
- Putnam Machine Co., Fitchburg, Mass.
- Niles Tool Works Co., Hamilton, Ohio

Experienced men are available for field service

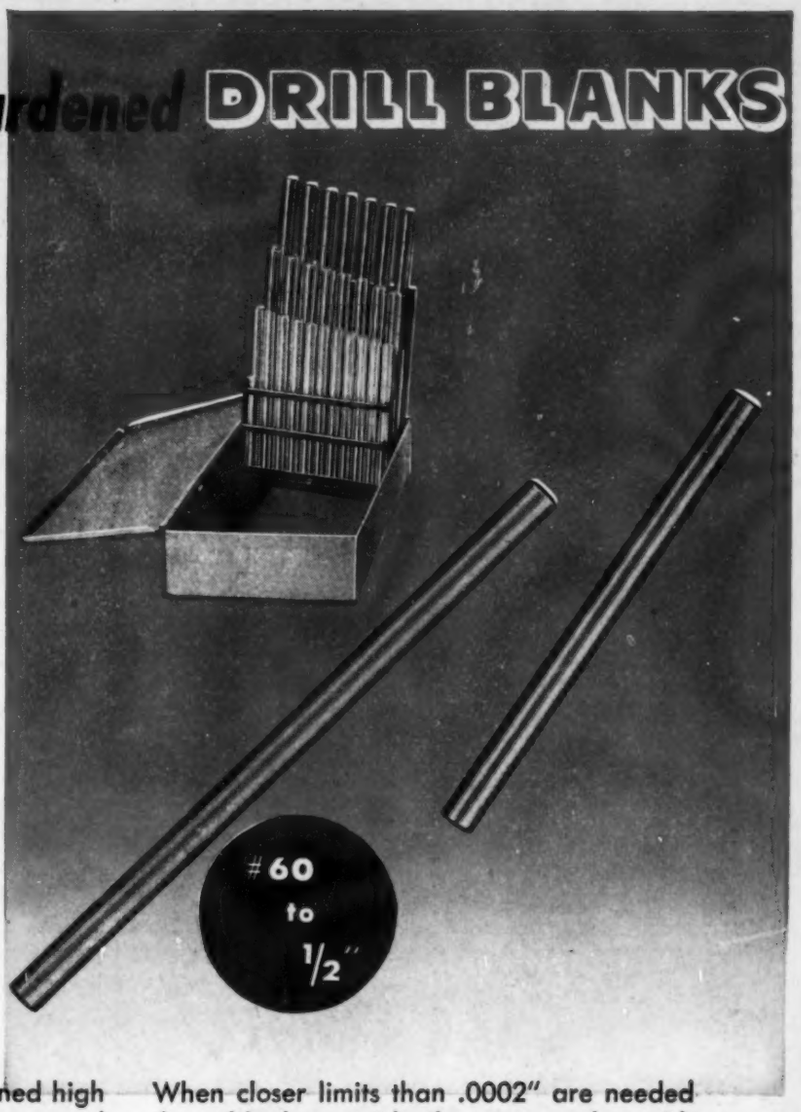
When New Tools Are Desired
BE SURE TO SEE NILES

SUBSIDIARIES: ★THE NILES TOOL WORKS COMPANY ★PUTNAM MACHINE COMPANY ★THE HOOVEN, OWENS, RENTSCHLER CO.
★THE HAMILTON PRESS AND MACHINERY CO. ★THE UNITED WELDING COMPANY

PRODUCTS: ★MACHINE TOOLS ★DIESEL AND STEAM ENGINES ★PRESSES ★CAN MAKING MACHINERY ★SPECIAL MACHINERY

Five Star Leadership

ACE uniformly hardened DRILL BLANKS



convenient—

At your finger tips in handy Huot cases. (115 sizes from stock)

adaptable—

Used as end cutting tools, plug gages, punches, etc.

economical—

Wire sizes 1—60 $22.90
Fractional 1/16—1/2 $24.85
Letter Sizes A—Z $22.45

Drill blanks are solid bars of hardened high speed steel, drill length, centerless ground to limits of +.0002"—.0000".

They are used primarily for checking hole sizes and as raw material for fabrication into cutting tools.

Blanks are widely used as inexpensive substitutes for plug gages when a tolerance of .0002" is sufficiently close. Tolerance permitting, they may be used instead of costly gage blocks on many inspection operations.

When closer limits than .0002" are needed these blanks provide the gage maker with a ready medium for lapping to the required tolerance.

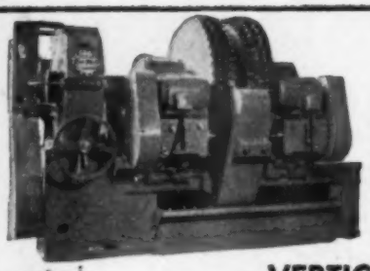
Among cutting tool applications are routers, countersinks, spot facers, reamers, end mills, tool bits, boring bar bits and blades for inserted cutters.

Miscellaneous uses include gear tooth gages, thread measuring wires, sine bar settings and punches.

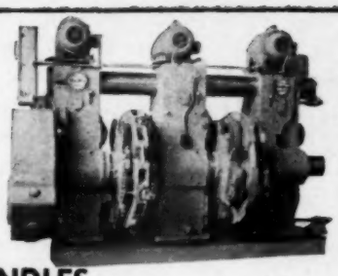
2257

ACE DRILL CORPORATION

MANUFACTURERS OF GROUND-FROM-THE-SOLID DRILLS AND REAMERS

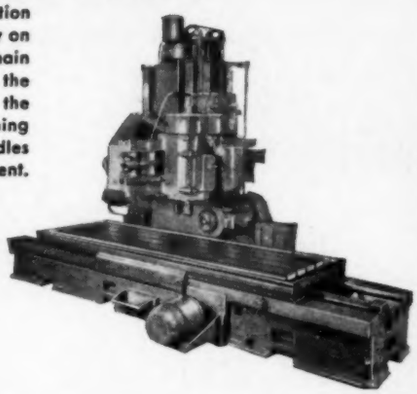


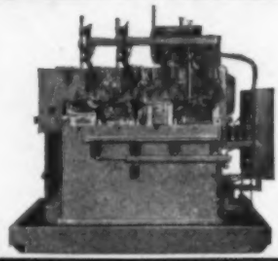
Roto-Matic MILLERS

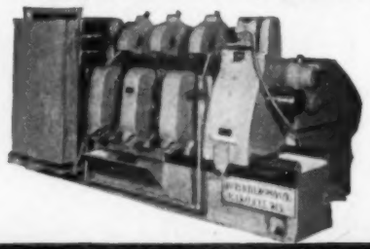


ROTARY DRUM TYPES •
VERTICALS • SINGLE AND MULTIPLE SPINDLES
PLANERS • RISE AND FALL • VERTICAL INDEXING

The ROTO-MATIC principle of continuous production insures the maximum of production and accuracy on any job to which a Miller has been adapted. Chain clamping mechanisms, where adapted, leave the operator free to load and unload parts. On the larger type Rotary Drum Type Millers finishing spindles are adjustable for toe cut. All spindles have provisions for micrometric endwise adjustment.







MILLING • DRILLING • REAMING • BORING • PIPE THREADING • SPECIAL MACHINES

DAVIS & THOMPSON COMPANY

MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES

MILWAUKEE WISCONSIN

Angular Drilling Simplified

With the set-up illustrated, 4 angular holes can be drilled at once with Govro-Nelson Self-Contained Automatic Drilling Units. The number, location or angularity of the holes can be changed by re-locating the Units, making the set-up adaptable to different production runs.

Send for literature giving list of prominent users, together with typical applications covering a variety of drilling jobs.

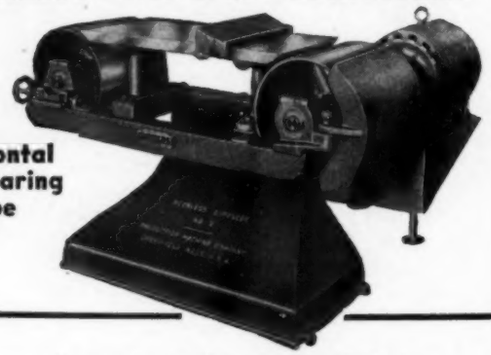
WRITE FOR Literature

GOVRO-NELSON CO.
1933 Antoinette
DETROIT 8, MICH.

Automatic DRILLING UNIT

"PEERLESS" No. 2-14" SURFACERS

Horizontal Ball Bearing Type



. . . for straight-grain finish at faster speeds and lower costs

These machines eliminate hand sanding and filing with resulting economies in time and material. Cutting action is fast and uniform because all points on the abrasive belt travel at the same rate of speed. Furthermore a straight-grained finish is attained with all the advantages which accrue.

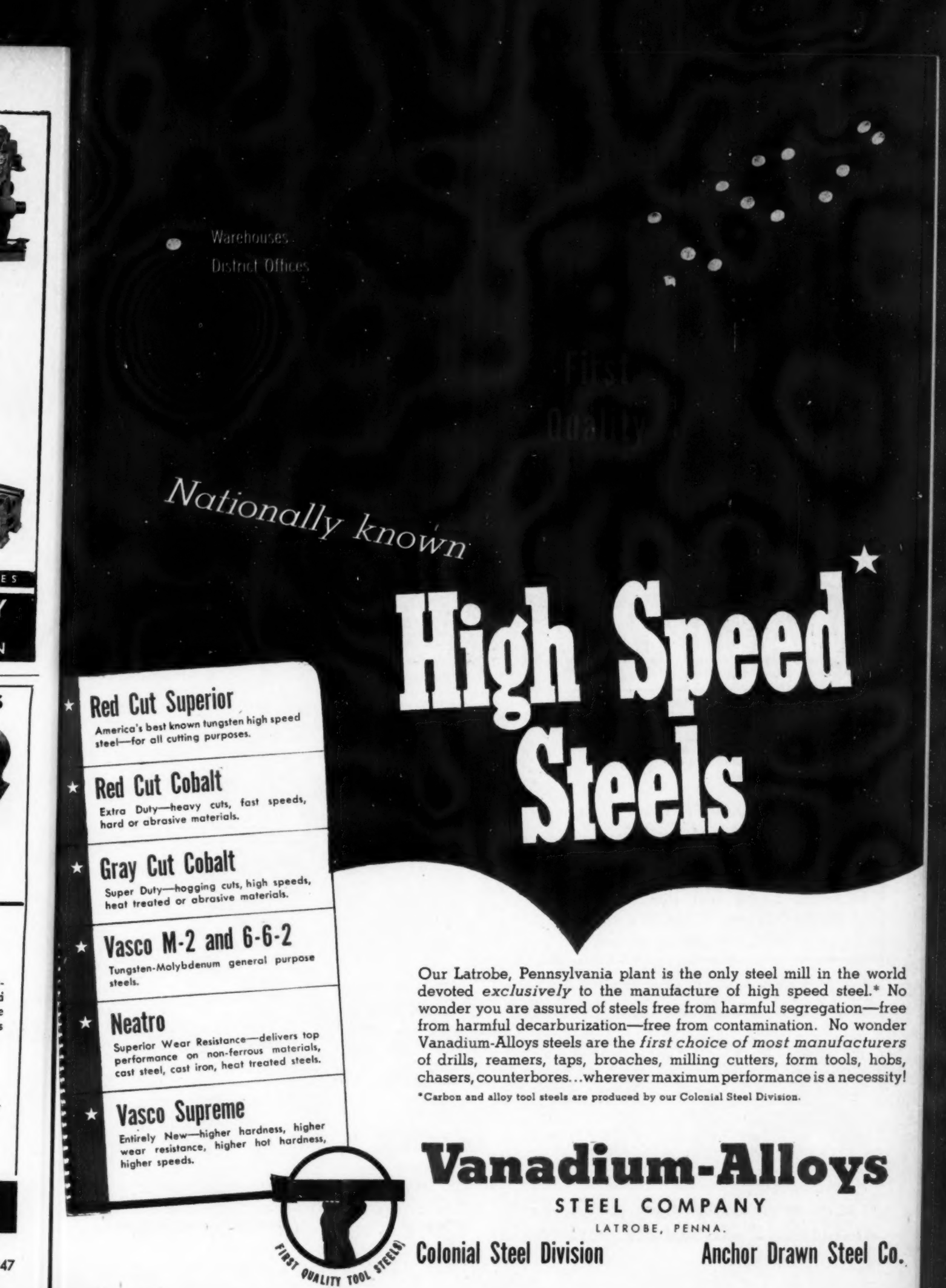
Ideal for grinding and sanding flat surfaces.

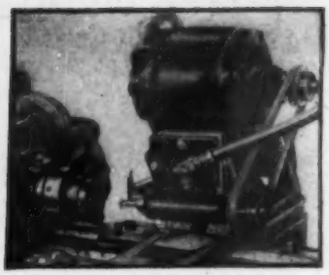
FEATURES

Removable Gauge and Dust Hood
Easily Adjusted abrasive belt
Dynamically balanced drums
Self-aligning ball bearings
Available for belt or direct motor drive

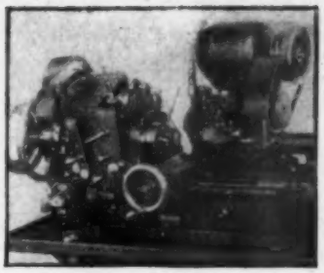
Full details on request

Production MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

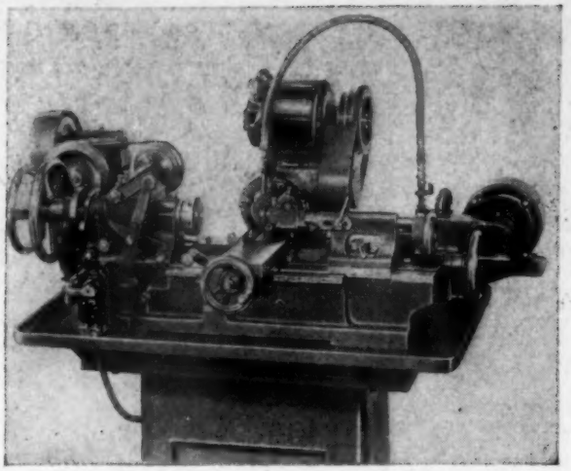

Warehouses
District Offices
First Quality
Nationally known
High Speed Steels
★ Red Cut Superior
America's best known tungsten high speed steel—for all cutting purposes.
★ Red Cut Cobalt
Extra Duty—heavy cuts, fast speeds, hard or abrasive materials.
★ Gray Cut Cobalt
Super Duty—hogging cuts, high speeds, heat treated or abrasive materials.
★ Vasco M-2 and 6-6-2
Tungsten-Molybdenum general purpose steels.
★ Neatro
Superior Wear Resistance—delivers top performance on non-ferrous materials, cast steel, cast iron, heat treated steels.
★ Vasco Supreme
Entirely New—higher hardness, higher wear resistance, higher hot hardness, higher speeds.
FIRST QUALITY TOOL STEELS!
Our Latrobe, Pennsylvania plant is the only steel mill in the world devoted *exclusively* to the manufacture of high speed steel.* No wonder you are assured of steels free from harmful segregation—free from harmful decarburization—free from contamination. No wonder Vanadium-Alloys steels are the *first choice of most manufacturers* of drills, reamers, taps, broaches, milling cutters, form tools, hobs, chasers, counterbores...wherever maximum performance is a necessity!
*Carbon and alloy tool steels are produced by our Colonial Steel Division.
Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.
Colonial Steel Division
Anchor Drawn Steel Co.



Machine equipped with Internal Milling Attachment



Machine equipped with Relieving Head



ALL STANDARD FORMS OF THREADS CAN BE PRODUCED TO CLOSEST TOLERANCES ON

WALTHAM THREAD MILLERS

Three motors on these machines provide a wide flexibility in operation as well as a constant supply of coolant for all requirements. By simply changing ratios, speeds are suitable for cutting either brass or steel. Waltham can furnish cutters for any thread form desired.

Machines are mounted on cabinet base with two shelves inside. Standard equipment includes: three motors with push button start and automatic or push button stop—follow rest—one milling cutter—indexing device for cutting multiple threads—5 pitch lead screw—change gears for cutting from 5 to 40 threads per inch.

Special Equipment Extends Utility

Extra equipment includes: a special work head for relieving—a special motor driven cutter head for internal threading—a multiple cutter threading attachment—automatic cam operation—special tailstock for multiple cutter work—translating gears for cutting metric threads—metric lead screw—plain taper attachment.

Write for Bulletin 244A giving detailed information.

WALTHAM MACHINE WORKS

WALTHAM, MASS.

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.

GEAR CUTTING MACHINES

Well Designed
Good Features
Create Production Advantages

43 Years' Experience

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK 5, NEW JERSEY
FRANK E. EBERHARDT, *President*

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
913 Tilden St.
Saginaw, Michigan

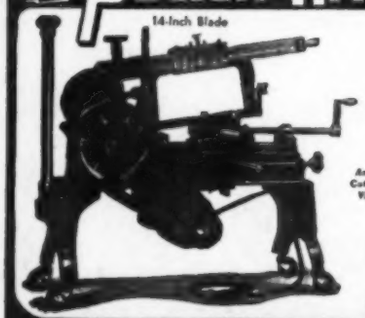
Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

OLIVER OF ADRIAN PRODUCTS

Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.

POWER HACK SAW ★



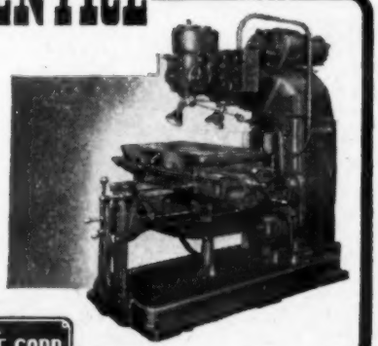
LOW PRICED
SELF-CONTAINED
PORTABLE
STURDY
Angle Cutting Vise
READY TO WORK
ECONOMICAL
EXPORT DEPT.
1111 SO. FERRY BLD'G.
NEW YORK 4, N.Y.

WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

REED-PRENTICE

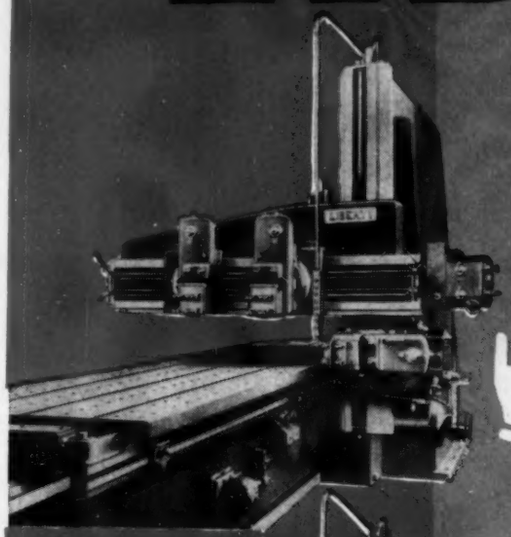
LATHES
DIE CASTERS
DIE SINKERS
VERTICAL MILLERS
INJECTION MOLDERS



REED-PRENTICE CORP.
WORCESTER MASS. U.S.A.

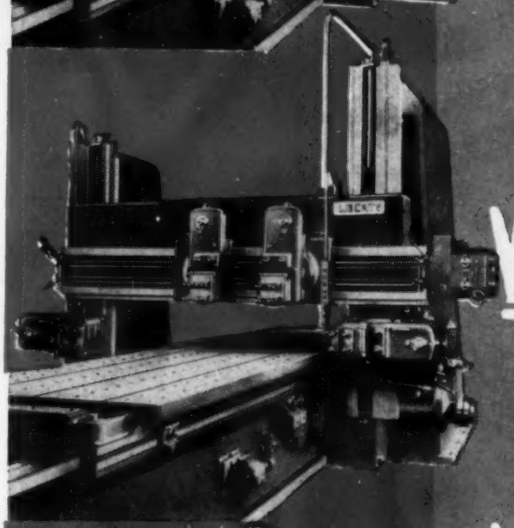
LIBERTY

MAKES ALL THREE



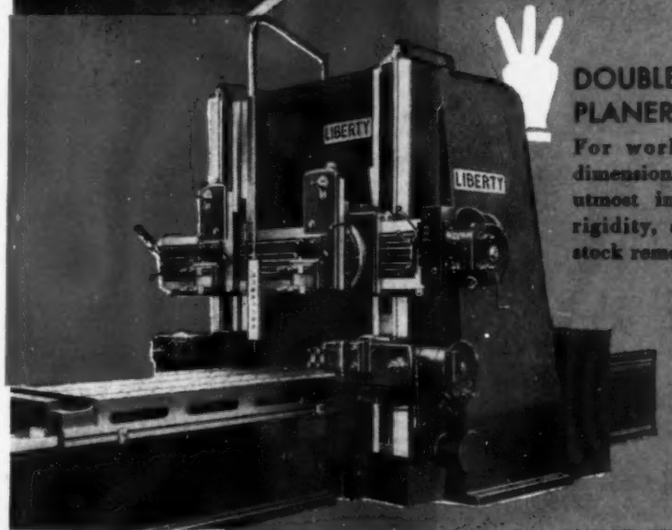
OPEN SIDE PLANERS

For work of variable widths which may extend beyond the normal clearance between housings.



CONVERTIBLE PLANERS

For heavy duty application on accurate, undetermined widths of work where the additional support of a left hand housing is desirable.



DOUBLE HOUSING PLANERS

For work of specific dimensions requiring the utmost in accuracy and rigidity, and maximum stock removal.

Yes, Liberty offers industry fast-operating machines in a full range of sizes capable of planing capacity from 24 inches to 12 feet wide—and even more when required. In addition, special modified designs such as Frog and Switch, widened and raised patterns and other expanded facilities are available to meet your specific needs.

Every Liberty Planer is the culmination of 30 years experience devoted to the engineering, design, production and application of fine planers. The result is equipment of outstanding productivity, accuracy, operating control and safety on which operating speed is limited only by the work or tools you use.

Investigate Liberty! Send for complete information, today!

LIBERTY PLANERS, INC.

HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON STREET, CHICAGO 6

With Exclusive Representatives Throughout the World

FULL BALL BEARING CONSTRUCTION

"Multiple Barreled" Profit Makers

Special *fixed-center* THRIFTMASTER Drillheads to your blueprints. Standard Adjustable Drillheads are the popular 2- to 6-spindle in capacities to 1½" drills. Recommendations for standard or special drillheads made promptly and without obligation.

12 Spindles on fixed centers. *For Drilling, Tapping, Reaming, Counter-sinking, End Milling, Spot Facing, Hollow Milling.*

FIXED CENTER and STANDARD ADJUSTABLE

Drillheads

THRIFTMASTER

Reps. in CHICAGO.....Geis-Arnold Co., 1553 West Madison Street
CLEVELAND.....T. J. Fraser Tool & Supply Co., 13413 Euclid Avenue
PITTSBURGH.....Voss Machinery Co., 2882 West Liberty Avenue
BOSTON.....A. R. Shevlin Co., 258 Park Square Building
DETROIT.....B. E. Parish Co., 3340 Fenkell Avenue
• Dealers in most cities •

THRIFTMASTER PRODUCTS DIVISION *THOMSON INDUSTRIES, INC.*
29-05 Review Avenue, Long Island City 1, New York

Hammond of KALAMAZOO

OD-9 CYLINDRICAL FINISHING MACHINE

For Faster, Better Finishing of Tubes, Rods, Bars and a Wide Variety of Cylindrical Shapes.

CENTERLESS No holding or chucking.

VERSATILE Uses abrasive belts or polishing and buffing wheels.

FAST UP to 30′ per minute.

For plunge cut or through feed. Idler roll fixtures as shown for long work. Send samples for detailed engineering report . . . no obligation.

VISIT OUR BOOTHS 235 and 239, WESTERN METAL CONGRESS. OAKLAND, CALIFORNIA. MARCH 22-27

Hammond Machinery Builders INC.

1618 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

HOUGHTON'S

ANTISEP

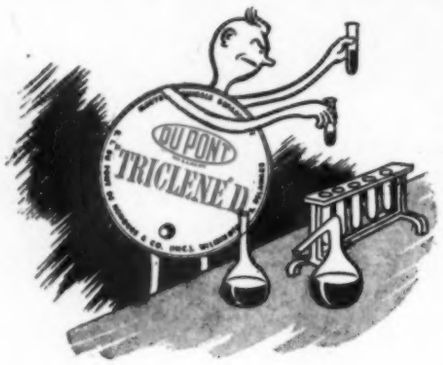
-the oil that's changing cutting fluid standards

Here's why:

1. It's antiseptically treated — combats skin irritations, prevents rancidity arising from bacterial growth.
2. It has remarkable wetting and cleansing power — no gumming of machines, lines or reservoirs.
3. It makes a permanently stable emulsion with water.
4. It protects against rusting of work or tools.
5. It prevents blueing or burning of work . . . no loading of grinding wheels.
6. It also does the conventional jobs claimed for all oils — providing longer tool life and better work finish.
7. It's economical, because it permits higher dilutions and has a longer usable life.

For those many reasons, Antisep Soluble Oil is rapidly becoming the first choice of machine tool operators and management. To test it in your plant, write E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.

For Better Metal Degreasing—
Du Pont Solvents



NOW Du Pont has developed a new and improved Trichlorethylene which is BETTER THAN EVER. This product and Perchlorethylene are two fine solvents. They are the best Vapor Degreasing solvents we've ever made—the best we know how to make. Use them with complete confidence and assurance for all metal degreasing work. We believe they'll serve you *better!*

UNDER VARIOUS TRADE NAMES, Du Pont Trichlorethylene and Perchlorethylene solvents for metal cleaning have served American industry successfully for many years. If you have used vapor degreasing solvents in your plant, no doubt you have used these solvents made by Du Pont.

LOOK TO the service offered by Du Pont and by distributors of Du Pont solvents to help you conserve your solvents through effective and economic operation. Send *today* for your copy of "Metal Degreasing—Standard Practice." E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

DU PONT SOLVENTS
for VAPOR DEGREASING

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

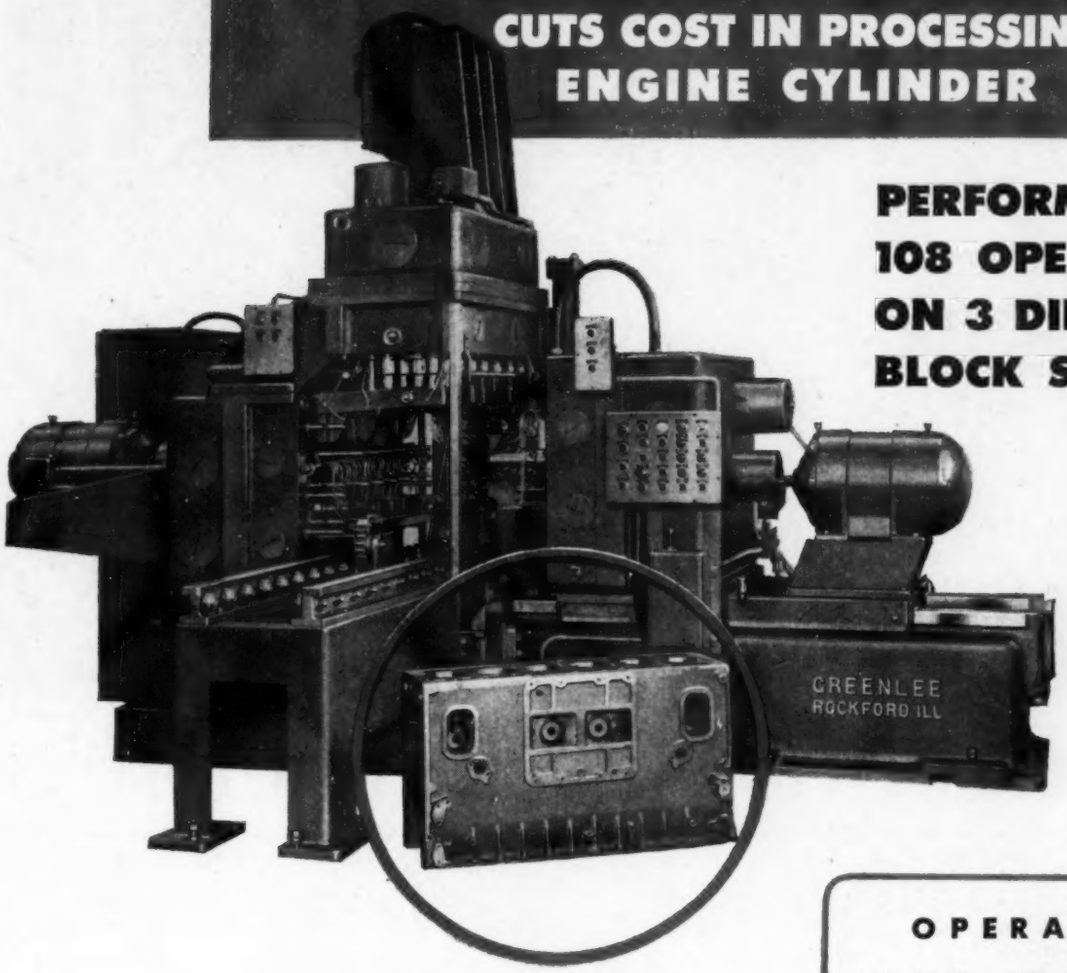
SOLD NATIONALLY THROUGH DISTRIBUTORS

DU PONT

REG. U.S. PAT. OFF.

SPECIAL 3-PURPOSE GREENLEE

CUTS COST IN PROCESSING DIESEL ENGINE CYLINDER BLOCKS



PERFORMS UP TO 108 OPERATIONS ON 3 DIFFERENT BLOCK SIZES

This 4-way horizontal and vertical machine, featuring individual lead screws on 131 spindles, performs the tapping operations on diesel engine blocks of 3, 4, and 6-cylinder sizes. The number of holes tapped in each size block are listed in the table at the right. Spindles are selectively tooled as the blocks require. This machine is one of a group of 6 GREENLEE 3-PURPOSE Specials for drilling, reaming, counterboring, and tapping operations. The principle of the three-in-one design cuts equipment costs and conserves floor space.

POWER LOADING AND UNLOADING REDUCES OPERATOR FATIGUE

The operator only has to slide the block from a conveyor line into position in front of the machine, and push a button. The machine performs all its work automatically, delivering the finished piece back to the starting position. This method of work-handling, also a feature of the five other machines, reduces operator fatigue and increases efficiency.

OPERATIONS

3-CYL. BLOCK	4-CYL. BLOCK	6-CYL. BLOCK
L.H. Head (39 Spindles)		
Taps 19 holes	Taps 21 holes	Taps 27 holes
R.H. Head (37 Spindles)		
Taps 18 holes	Taps 18 holes	Taps 26 holes
Vertical Head (28 Spindles)		
Taps 14 holes	Taps 18 holes	Taps 28 holes
Rear Head (27 Spindles)		
Taps 27 holes	Taps 27 holes	Taps 27 holes
TOTAL		
78	84	108

PRODUCTION MACHINERY

GREENLEE

Write for Bulletin 1046, giving a detailed description of these Special 3-Purpose Machines. Perhaps similar methods can be applied to solve your own production problems.

GREENLEE BROS. & CO.
1723 MASON AVE., ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

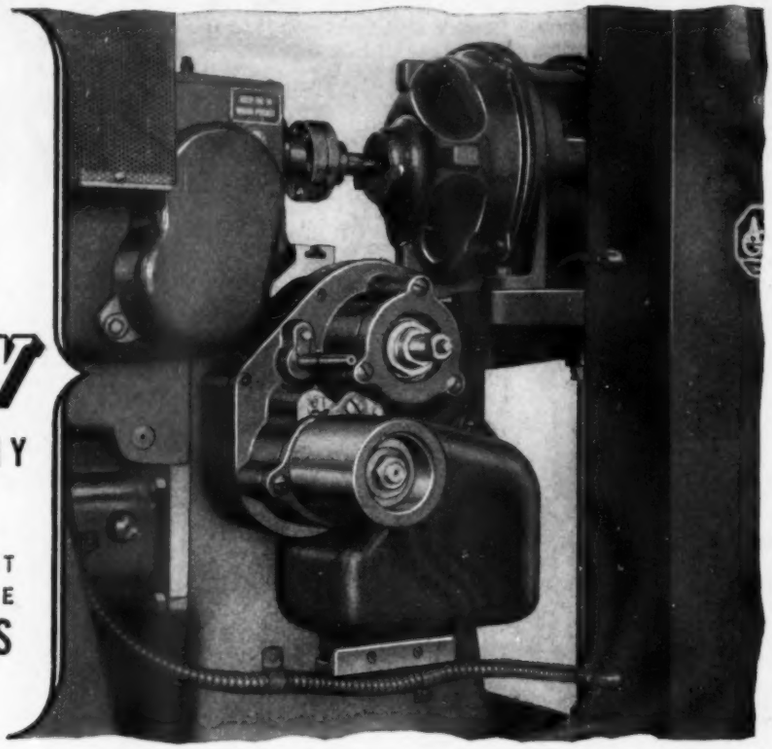
Goss & DeLeeuw

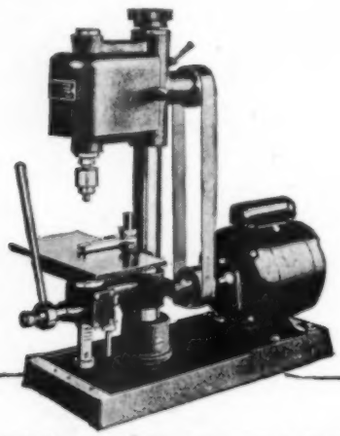
MACHINE COMPANY

NEW BRITAIN - CONN.

★

THE WORLD'S FINEST
MULTIPLE SPINDLE
CHUCKING MACHINES





INSTRUMENT TAPPER
(SUPER-SENSITIVE)

The Hamilton Super-Sensitive Tapping Machine is designed for the precision industries. Tapping capacity, from the smallest and finest tap to 10-32 inclusive.

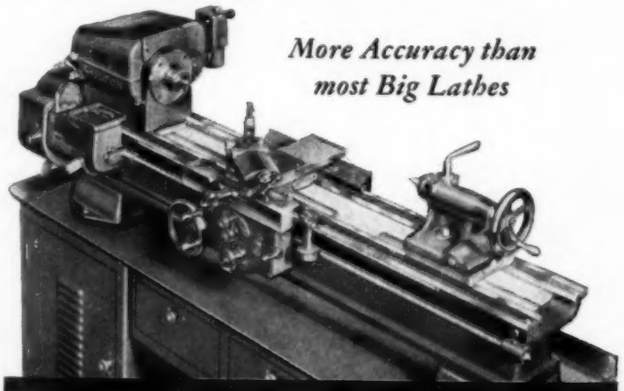
This machine has every wanted feature. Ease of operation. Height adjustable table. Adjustable stops. Ample clearances and travel. Silent and clean in operation.

Patented power transmission permits centering of tap without cutting and tapping to the very bottom of blind holes without tap breakage.

Our Bulletin T-47 gives the story and specifications complete. Write for it.

THE Hamilton TOOL COMPANY

830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A



More Accuracy than most Big Lathes

New SHELDON
TRB-S56 Precision Lathes

There is a degree of accuracy built into the new $1000.00 Sheldon TRB-S56 Precision Lathe heretofore found only in a few of even the most costly lathes. For example, spindle bearings are "Zero Precision," the very finest, closest tolerance tapered roller bearing manufactured. The heavily strutted, 1-piece bed has 2 V-ways and 2-flat ways ground on special bed grinder and held to the closest tolerance of lateral and parallel alignment. The lead screws are milled on the most accurate special lead screw milling machine.

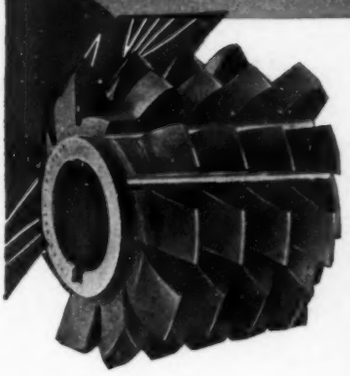
In the Sheldon TRB-S56 modern engineering, extensive tooling combined with the finest special machinery — a modern machine tool plant with modern equipment, modern manufacturing methods — give this small (11¾" swing, 1" collet capacity, 56" bed, 8 speed—50 to 1350 r.p.m.), convenient, moderate priced lathe, the permanent accuracy and features, heretofore found only in more cumbersome and costly lathes.

Write for circular

SHELDON MACHINE CO. Inc.

4234 NO. KNOX AVENUE, CHICAGO 41, ILL., U. S. A.

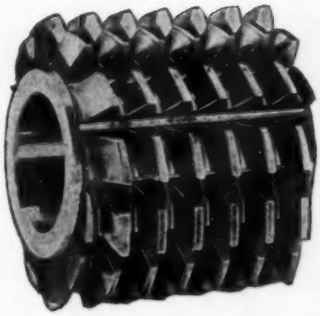
HOBS
of many
kinds
for many needs
where precision
and durability
are required

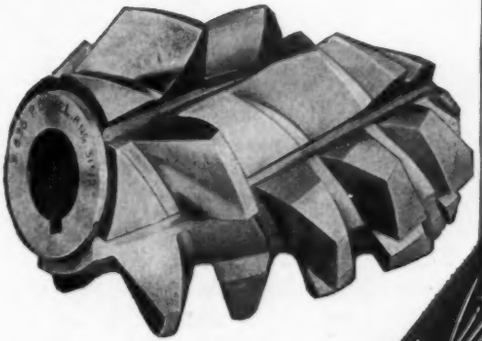


NATIONAL
CLEVELAND
TOOLS

NATIONAL Tools CLEVELAND

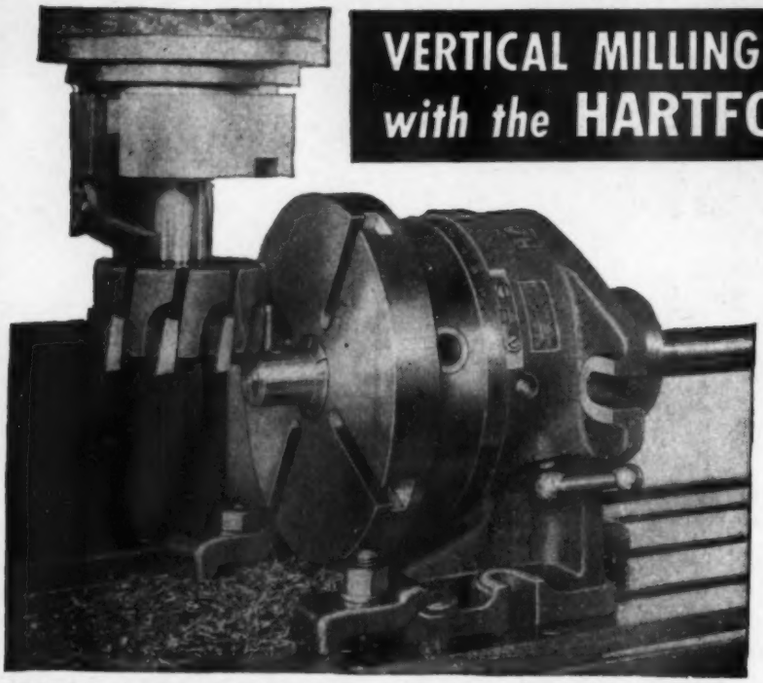
Cutting Tools for
All Purposes





Herringbone Cutters,
Broaches, Gear Cutters,
Gear Shaper Cutters,
Circular and Flat
Form Tools,
Form Relieved Cutters,
ground and unground,
Hobs,
ground and unground,
Milling Cutters,
Special Tools

NATIONAL TOOL Co.
11200 MADISON AVE
NATIONAL Tools CLEVELAND
CLEVELAND, OHIO



VERTICAL MILLING . . . *a job easily handled with the* HARTFORD SUPER-SPACER

The outstanding convenience of the Hartford Super-Spacer as a means of handling unusual setups is illustrated here. This example of vertical milling is simplified by mounting a face-plate on the Super-Spacer and providing a draw-in collet. Adaptability with this combination for milling bar stock is apparent.

Milling is but one of many operations where the Super-Spacer is proving a profitable solution to tool room and production problems. Grinding, drilling, planing, slotting and jig-boring are also being speeded up and accurate indexing maintained through the use of this modern spacing device. The Hartford Super-Spacer merits your most careful and prompt investigation.

Write us today for further details.

The HARTFORD
SPECIAL MACHINERY CO.
HARTFORD 5, CONN.

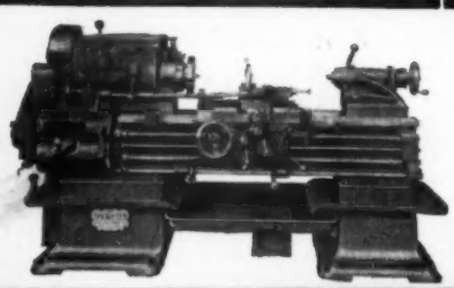
CARLTON RADIAL DRILL

FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

THE CARLTON MACHINE TOOL COMPANY

CINCINNATI 25, OHIO, U. S. A.

SPRINGFIELD GEARED HEAD LATHES



. . . versatile, efficient!

Springfield designs lathes to retain accuracy and speed over long periods of use. For quantity production or special use they're economical and extremely adaptable. Sizes available range from 14" to 30". *Write for descriptive bulletins, prices and deliveries.*

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

REPORT No. 1- ON TANTUNG *

REPORT No. 1	TOOL ENGINEERING REPORT	DATE: 1947

MATERIAL: Non-ferrous cast alloy. A homogeneous composition of Cobalt, Chromium, Tungsten, Carbon and Columbium/Tantalum carbides.

TRADE NAME: TANTUNG

GRADE: "G"

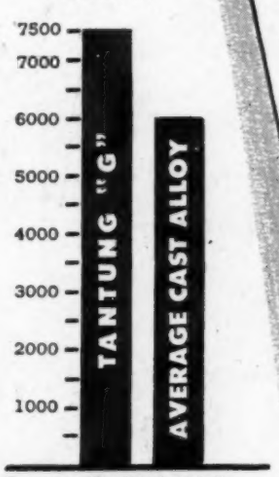
APPLICATION: For all machining and cutting operations. Cuts rolled, forged or cast steels—annealed or heat treated, cast irons, nonferrous and non-metallic materials.

PROPERTIES: *Density:* 8.8 gms per c.c. or 145 gms per cu. in. *Transverse Rupture Test:* Average breaking load of ⅜" square specimen on 1½" centers is 7,500 lbs., equivalent to 320,000 psi.

CHARACTERISTICS: Performs at far greater speeds and feeds than high speed steels—produces 100% to 1,000% more pieces per grind. Easily ground, TANTUNG "G" is a tough, shock resistant cast alloy with an extremely low coefficient of friction. *Of particular interest is its high red hardness.*

DETAIL DATA: TANTUNG "G" is a general purpose cutting tool material adaptable to any machining operation using high speed steels and to many applications where carbides prove unsatisfactory. Easy to grind, TANTUNG "G" offers distinct advantages for smaller shops not having tool rooms for carbide grinding. Because of the higher rake angles possible, TANTUNG "G" is the ideal tool for present or old equipment without requiring increased horsepower. Its high transverse rupture strength permits its use as a solid tool, readily adaptable to the average tool holder. Easily brazed in a pocket or to a flat surface by standard brazing practice. Grain size and hardness are controlled by casting methods, imparting advantageous properties to TANTUNG "G" making it ideal for industrial applications such as shears, knife blades, wood working tools, etc. in addition to its superior performance in ferrous, non-ferrous and non-metallic cutting.

In eight years more than 3 million Tantung tools have performed successfully.



Transverse Breaking Load in lbs. on ⅜" Square Bar, 1½" Centers

Write today for your copy of TANTUNG Bulletin VR-227. Address request to Dept. TT347.

MAKERS OF WORLD'S FINEST VR Carbides

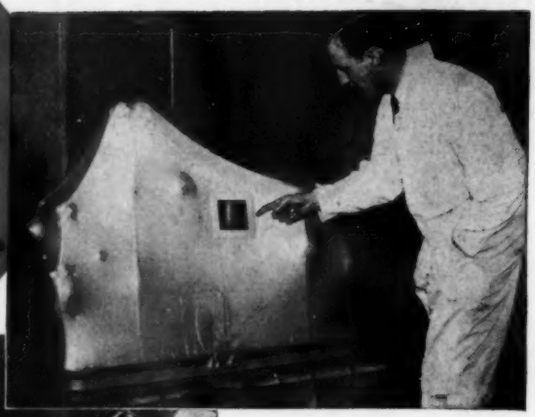
*Reg. U. S. Pat. Off.

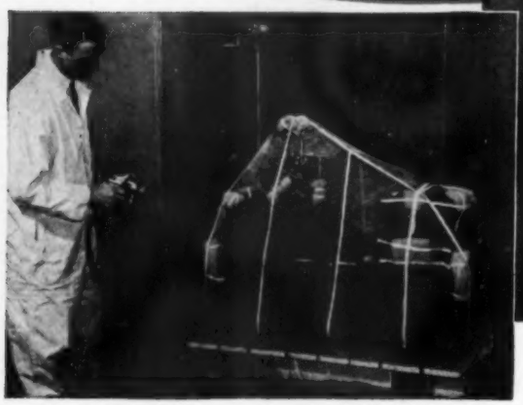
VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS. U. S. A.
District Sales and Service in Principal Cities
AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

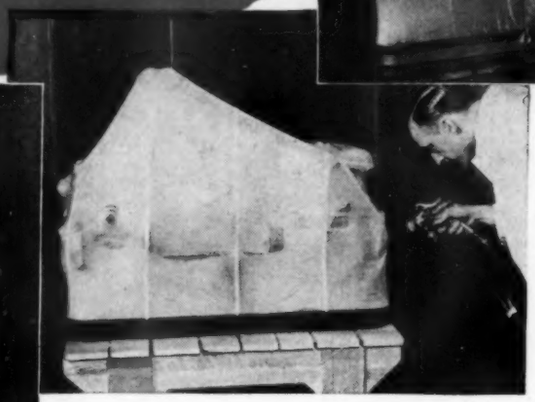
COCOON

PROTECTIVE PACKAGING

affords perfect protection at no extra cost!







You can give your shipments the best known protection *at no extra cost* with COCOON, the amazing new protective packaging applied with a spray gun.

The COCOON system gives you the best possible protection at a cost that is no higher—and in many cases, actually lower—than conventional, less efficient methods of providing a moisture vapor barrier. It eliminates the application *and the removal* of messy preservatives, saves on packing costs and on the cube and weight of the completed shipment.

COCOON affords perfect protection against snow, rain, sun . . . keeps safe *anywhere* anything from a ball bearing to a locomotive. Submit your protective packaging problem to us for analysis! *R. M. Hollingshead Corporation, Camden, New Jersey; Toronto, Canada.*

IMPORTANT

The number and scope of inquiries about COCOON is amazing. To help us answer *your* inquiry quickly—to make it possible to give you a comprehensive recommendation—please give us as many details as possible, including: the item to be protected; range of sizes; extent of protection required, and for how long; whether your problem involves storage, domestic or export shipment. Descriptive literature or photographs of your product are very helpful.

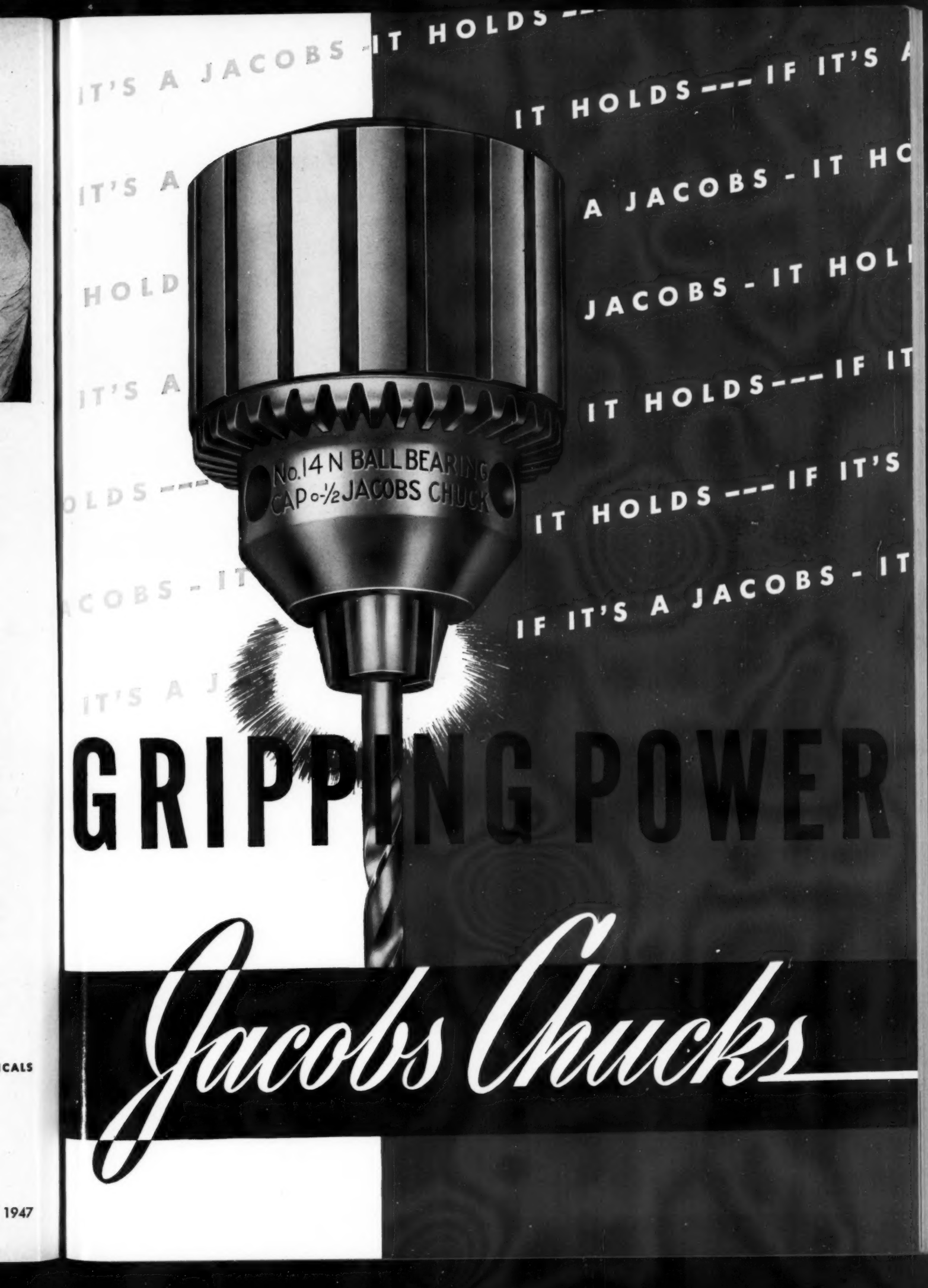
Whiz

Package with COCOON

A PRODUCT OF *Hollingshead* LEADER IN MAINTENANCE CHEMICALS

Applied with a spray gun

Strips off like a banana peel


IT'S A JACOBS - IT HOLDS ---
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IF IT'S A JACOBS - IT
No. 14 N BALL BEARING
CAP o-½ JACOBS CHUCK
GRIPPING POWER
Jacobs Chucks

HOW JACOBS BUILDS-IN GRIPPING POWER

STRICT INSPECTION CONTROL Maintained by an inspection staff independent of manufacturing supervision. Highly specialized gauging methods keep dimensions and tolerances for each operation on each part to strict precision. Final inspection is 100%.

METALLURGY High grade tool steels to exact alloy formulas are exclusively used. Our own heat treating equipment hardens and toughens gripping areas while retaining adequate core strength. Surface hardening by modern electronic methods assures long service life to areas subject to wear.

ENGINEERING DETAIL Progressive scale product drawings guide each operation to assure fidelity to the Jacobs design for gripping power plus accuracy plus durability under severe conditions of use. There are over 3500 active production drawings.

SPECIALIZED MACHINES Special automatic and semi-automatic machines developed and built by Jacobs are the result of forty-five years of specializing in one product—universal type drill chucks. More drill chucks have been produced by Jacobs than any other company in the world.

"IF IT'S A JACOBS, IT HOLDS!"

The Jacobs Manufacturing Company, Hartford 2, Connecticut, U. S. A.

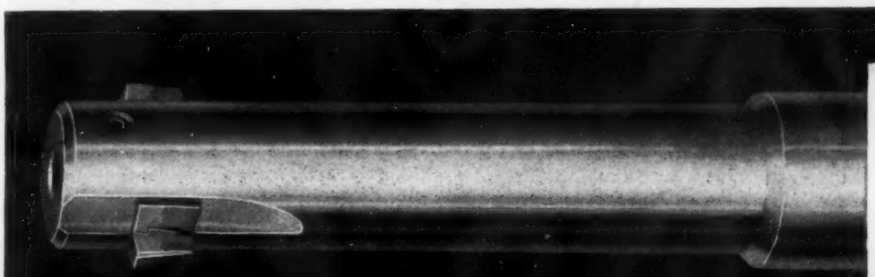
MADISON * *BOREAMING*

performs miracles with minutes

Madison *Boreaming* drastically cuts time from hole finishing and improves the quality of the holes obtained. Madison *Boreaming* is possible only with the use of the Madison Rough Boring Tool and the Madison Finish Boring Tool. Their features of simple and accurate operation will lower the cost of finished holes and achieve best results when you team them together.

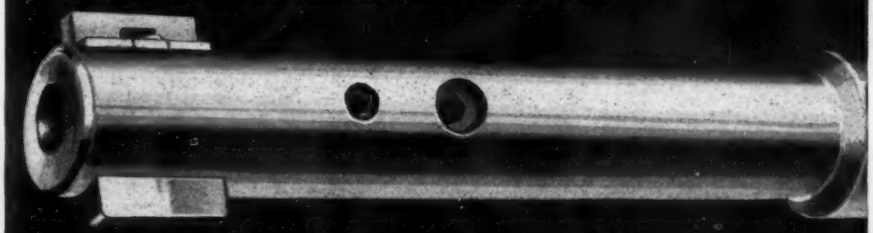
Madison *Boreaming* performed through the use of these two Madison tools will deliver finished holes which usually are achieved only through the use of three to five ordinary tools.

*Completed Boring Operation.



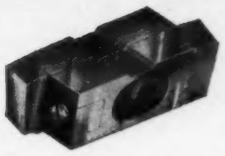
MADISON ROUGH BORING TOOL

In many cases, the Madison Rough Boring Tool will remove as much stock in one pass as an ordinary single point tool removes in three passes . . . and at faster speeds. Madison design assures rough bored holes that are straight and true, and ideally prepared for a better finishing job by the Madison Finish Boring Tool.

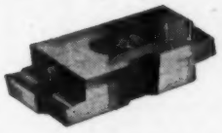


MADISON FINISH BORING TOOL

The Madison Finish Boring Tool works to exacting tolerances at high production speeds. The finish obtained is so fine that it seldom requires any additional finishing operation. The cutter may be held rigid or floated in the bar. No special, costly, floating tool holders or chucks are necessary.



Rough Boring Cutter

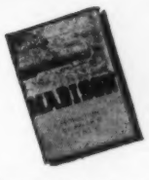


Finish Boring Cutter

The design features of Madison Finish Boring Cutters have been proven for over thirty years. The same effective features are incorporated in the new Madison Rough Boring Cutter. Both types have the exclusive Madison one-screw adjustment feature. In each cutter the blades themselves form the cutting block. . . . No delicate or loose parts to break, lose, or to complicate adjustment. Having only two blades, there is generous space for chip clearance and coolant circulation. Cutters may be expanded to compensate for wear and regrinding, and are easily sharpened.

FEATURES OF MADISON *BOREAMING

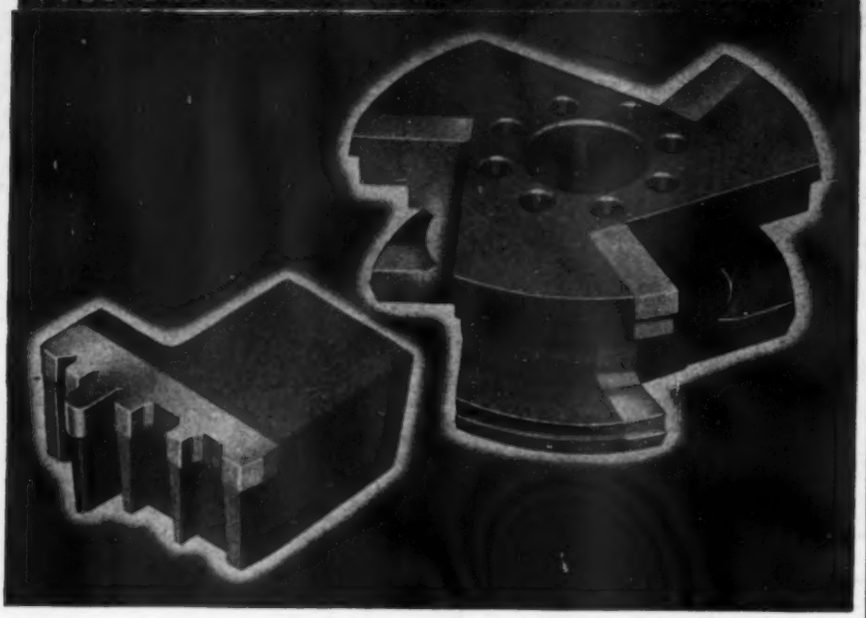
1. Often it is practicable to combine in one bar both the roughing and the finishing cutters, and perform both roughing and finishing in one pass of the tool.
2. A Madison cutter may be slipped from a Madison bar and set to different diameter or replaced by a sharpened cutter in a matter of seconds.
3. The Madison Rough Boring Tool and the Madison Finish Boring Tool are interchangeable in the same setup so that both operations may be performed successively if desired.
4. Madison's two-bladed cutter design has a free cutting action which in most cases permits faster speeds and greater feeds. Less friction means less heat, which in turn results in truer holes with a better finish and also prolongs tool life.
5. The cutter of the Madison Finish Boring Tool may be floated right in the bar. No special floating tool holders or chucks are necessary.



Put *Boreaming* to work for you. Write for the new Madison catalog . . . it shows complete lines, prices, and grinding instructions.

MADISON MANUFACTURING COMPANY
DEPT. AM-6 MUSKEGON, MICHIGAN

YESTERDAY'S PIONEER . . . TODAY'S LEADER



WELDON

CARBIDE FORM TOOLS

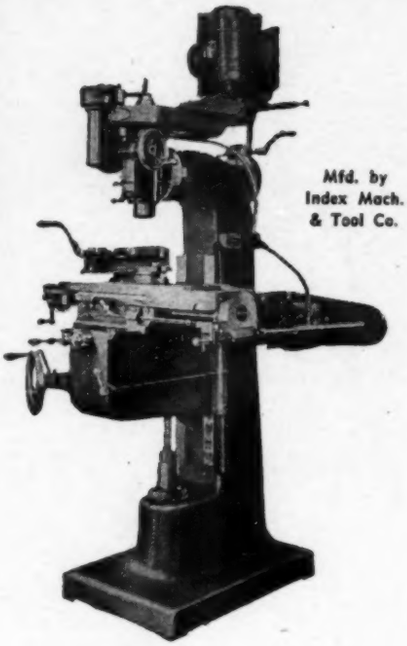
Flat or Circular

• Fully equipped with the most recent developments in carbide grinding machinery, Weldon is able to produce a practically unlimited range of complicated shapes in flat or circular form tools to special order.

Send us your specifications

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

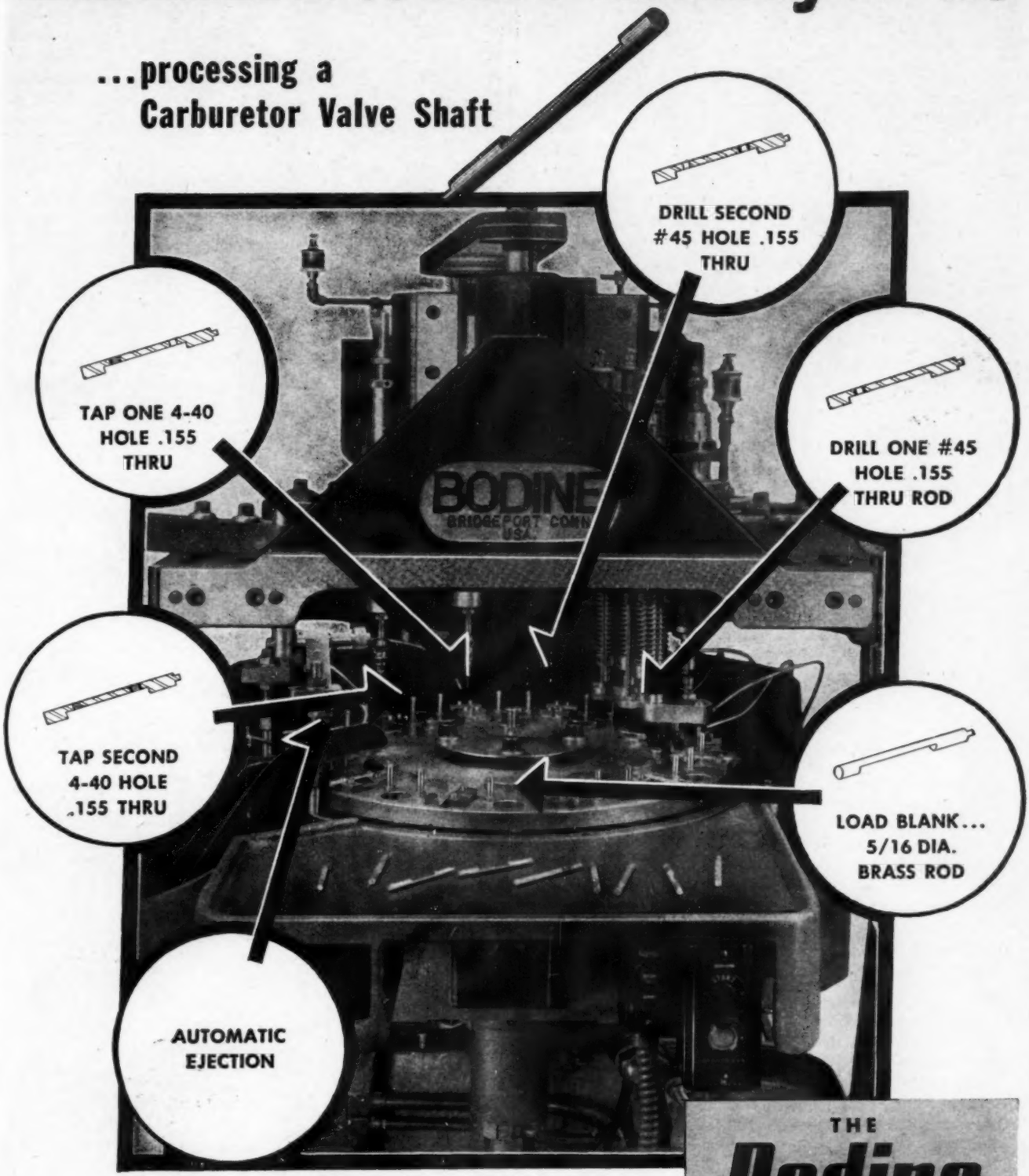
For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

Bodine..Case History No 16

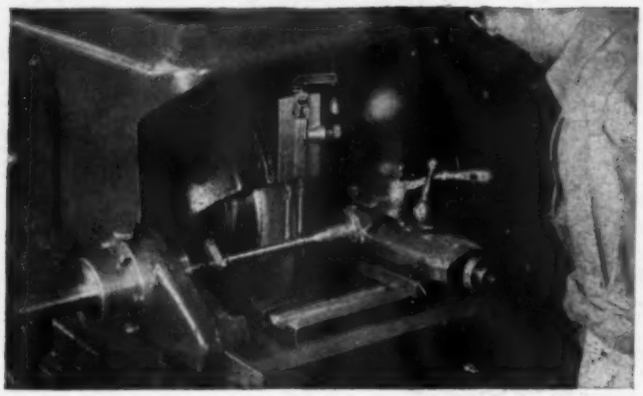
...processing a Carburetor Valve Shaft


DRILL SECOND #45 HOLE .155 THRU
TAP ONE 4-40 HOLE .155 THRU
DRILL ONE #45 HOLE .155 THRU ROD
TAP SECOND 4-40 HOLE .155 THRU
LOAD BLANK... 5/16 DIA. BRASS ROD
AUTOMATIC EJECTION
BODINE
BRIDGEPORT CONN
USA

• Production . . . 1250 pieces per 50 minute hour, one completed piece per stroke of the Bodine Dial type Drilling and Tapping Machine. Interesting Bulletin on request.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

3 point service



for better precision grinding!

The use of straight oils for precision, production grinding is resulting in spectacular improvements in finish, and making it possible to grind within tolerances never before thought practicable. If you want better grinding, it will pay you to investigate the Stuart line of grinding oils.

To improve metal-working efficiency, take advantage of Stuart 3-point service:

1 ***The right oil for the job*** . . . every oil in the complete Stuart line is formulated for a specific purpose. Whatever the job, there is a Stuart oil to handle it best.

2 ***Sound engineering*** . . . Stuart engineers and laboratory technicians are neither textbook theorists nor self-taught handymen. They are practical oil men thoroughly schooled in their profession by study and first-hand experience.

3 ***Intelligent, specialized service...*** Stuart representatives have an intimate knowledge of metal-working oil requirements, and of the advantages of each Stuart oil. They will study your oil problems and help you solve them. For further information, write for "Grinding With Oil," a 12-page booklet.

ThredKut 99
. . . for grinding tough, stringy metals . . . makes grinding wheels *"act harder."*

SUPERKOOL 81X
. . . for precision grinding on metals in middle range of grinding hardness.

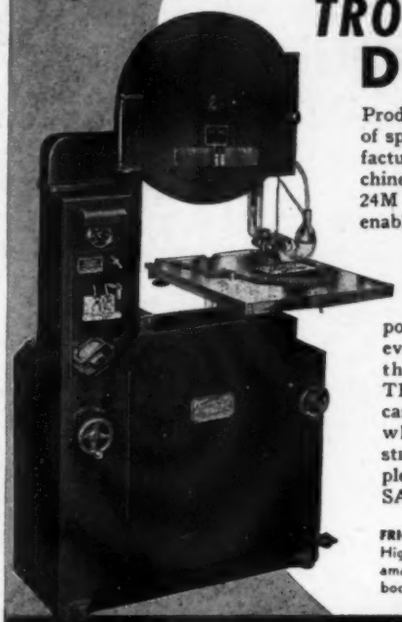
EXCELENE
. . . for grinding hard steels . . . makes grinding wheels *"act softer."*

D.A. Stuart Oil Co. LIMITED
EST. 1865
2729 SOUTH TROY STREET, CHICAGO 23, ILL.

STUART *service goes with every barrel*

Tannewitz

The RUGGED-
TROUBLE-FREE
DI-SAW



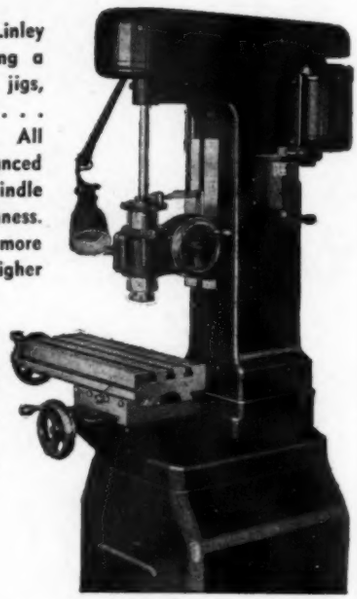
Product of more than 50 years of specialization in the manufacture of band sawing machinery the TANNEWITZ 24M is the machine that will enable you to capitalize to the fullest extent on the economies of contour sawing, inside and outside filing and polishing. It's rugged, with every detail of construction thoroughly proved, — TROUBLE-FREE. And it carries full 24-inch wheels which make for easier, straighter sawing. For complete details write for DI-SAW Bulletin.

FRICTION SAWING with Tannewitz High Speed Band Saws offers many amazing advantages. Write for free booklet.

THE TANNEWITZ WORKS
GRAND RAPIDS 4, MICHIGAN

BUSY TOOL-ROOMS
. . . NEED THIS UNIT!

You can't beat the compact Linley Miller and Jig Borer for doing a variety of work on small dies, jigs, fixtures, patterns and models . . . fast, accurately, economically. All rotating parts are carefully balanced giving the 8 velvet-smooth spindle speeds great operating smoothness. Build profits by saving larger, more expensive machines for their higher rated capacities.



Features also include: direct micrometer setting . . . anti-backlash quill travel . . . rapid setup . . . easy changeover. The Linley requires only 2½ sq. ft. of space, 7"x17½" table size is ample.

Look into these profit factors . . . NOW.

LINLEY BROTHERS COMPANY
864 STATE ST. EXTENSION
BRIDGEPORT 1, CONNECTICUT

With a Small Investment—

the SUNNEN PRECISION HONING MACHINE

Will Accurately Finish All Internal Diameters from .125" to 2.625"

The wide range of sizes which the Sunnen Precision Honing Machine will handle makes it adaptable to thousands of jobs in production plants, tool and die shops, maintenance shops and salvage departments. Honing heads and stones are available to hone any kind of metal, plastic or ceramic material except lead and babbitt.

Accuracy is guaranteed to be within .0001" — and on such materials as hardened steel it has been held to .000025" on production jobs. Surface finishes can be produced to meet any commercial requirement.

In thousands of shops the Sunnen Precision Honing Machine produces finishes that add extra life to bearing surfaces, saves material because it reduces rejects, and assures absolute interchangeability on closely mated parts.

The Sunnen Precision Honing Machine does not require skilled help — anyone who is mechanically inclined can learn to operate it in a few hours. No jigs or fixtures are needed — it can be put to work immediately. It is economical to operate.

A Sunnen engineer will be glad to show you how you can apply Sunnen honing to your jobs, in your plant. Call him in, or write for complete details. Ask for bulletin XSP5000.

SUNNEN PRODUCTS COMPANY, 7941 Manchester Avenue, St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario

Typical Examples

Universal bearing honed to 10 micro inch finish gives longer service.

Line reamer bushings, diameter 2.375", accuracy held to .0001".

Miniature aircraft cylinder—smooth, accurate honing provides better compression and longer life.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.

SUNNEN

194

RED-E-TOOLS

SAVE MONEY . . .
SPEED PRODUCTION . . .
SAFEGUARD PRECISION!

Improved . . . Balanced

CAM ACTION GRINDER DOG

"The dog without a bite"

If you are seeking increased production, this dog can be an important factor. It is easy to adjust, with instant positive holding action...yet may be used safely on precision finished work without danger of marring, because the cam face is ground smooth both as to surface and contour, thus reducing spoilage and rejects.

An excellent dog for all types of grinders and especially for semi-automatic machines, because once adjusted for size, all that is necessary in setting up work is to simply release the cam. The harder the drive, the tighter it grips.

Available in five sizes to take work from ⅛" to 2" diameter. Made entirely of steel with ground finish. Send for Catalog A-47

THE READY TOOL COMPANY
IRANISTAN & R. R. AVENUES
BRIDGEPORT, CONNECTICUT

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CEMENTED CARBIDE TIPPED LATHE & GRINDER CENTERS with the RED-E Safety "Life Line"

HIGH SPEED STEEL CENTERS

RED-E NEW DEPARTURE BALL BEARING CENTERS

RED-E STYLE X LATHE TOOL with the Tool Steel Bearing

MILLING MACHINE & FACE PLATE DOGS

GRINDER DOGS

Bulletins on any or all of these Products on request. RED-E-TOOLS

Just ONE setting per form
Just ONE continuous motion

"Fluidmotion"* FEATURES:

.01" accuracy • Automatic Center Grinding • "Fluidmotion" dressing • Dustproof and shatterless • hardened stainless steel • 7" & 14" wheel capacities • Highest quality diamonds

Prominent users tell us that they consider "Fluidmotion" Radii & Angle Dressers the finest precision dressing instruments procurable—regardless of cost. They obtain greater accuracy, longer wheel life, and much faster setup and operation.

We'll be glad to send you complete information. Write

*Reg. U. S. Pat. Off.

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Representatives in Principal Cities

Hammond of KALAMAZOO

BACKSTANDS

For converting standard Polishing Lathes into *high production* abrasive belt grinder-polisher units. Lifetime Machine tool construction.

HAMMOND "VRO" Variable Speed (1500 to 3000 RPM) Polishing and Buffing Lathe with two No. 3 Backstands.

MODEL No. 3 SHOWN

Write for new Catalog No. 55 covering Backstands, Polishing Lathes and many types of finishing machines including Automatics.

VISIT OUR BOOTHS 235 and 239, WESTERN METAL CONGRESS. OAKLAND, CALIFORNIA. MARCH 22-27

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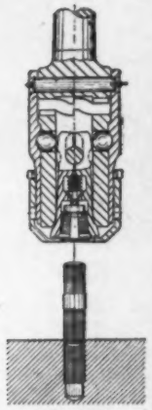
MODERN SELF-OPENING STUD SETTERS

Used by practically all builders of automobiles, trucks, tractors and diesel engines.

A fast, economical and convenient means to greater production for those who have studs to set in quantity.

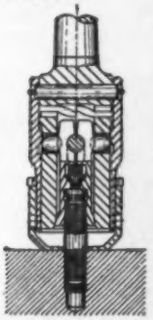
BECAUSE . . .

This tool does the job in a single continuous operation. It sets the stud, then opens automatically. No reversing. No backing off the stud.



Tool brought to position over stud, ready to begin drive.

Start of the drive with tool engaged on the stud.



Drive completed. Clutch released.

Modern Precision Tools Include . . .

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- ROTARY SELF-OPENING DIE HEADS
- STATIONARY COLLAPSIBLE TAPS
- ROTARY COLLAPSIBLE TAPS
- MODERN-MAGIC CHUCKS AND COLLETS
- SELF-OPENING STUD SETTERS
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- SOLID ADJUSTABLE DIE HEADS
- ADJUSTABLE HOLLOW MILLING TOOLS
- UNIVERSAL CHASER GRINDING FIXTURES

can be operated in any position with either air or electrically operated portable tools. It can also be used in a drill press, where it is possible to drill and tap the holes and set the studs in successive operations.

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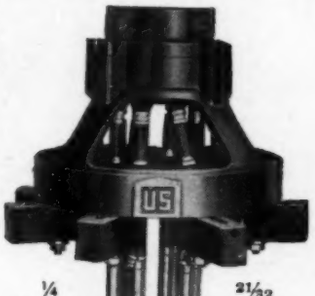

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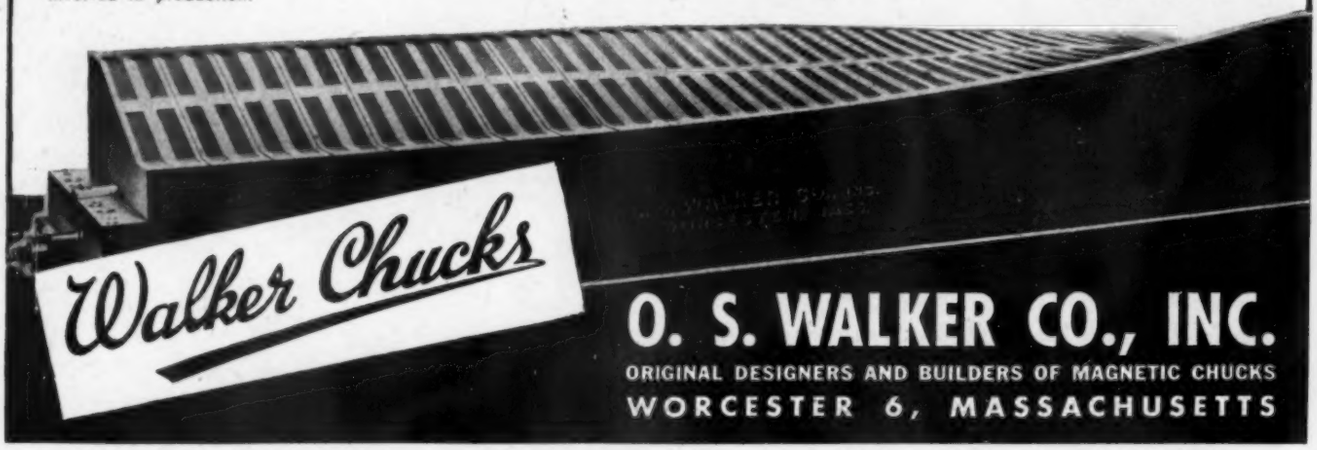

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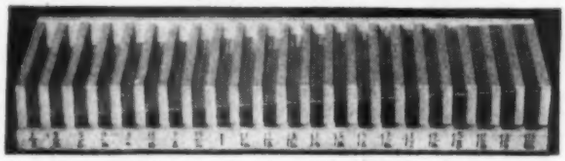

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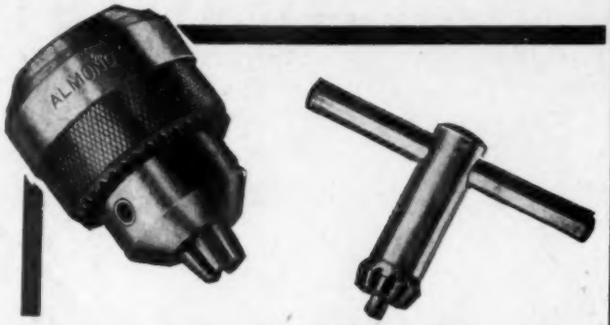

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I talked with a General Foreman . . .

the other day. He's a little bashful, so I'll just call him by his first name: "Bill".

Bill is an ingenious fellow, often coming up with ideas that turn out very profitably—not only for Bill's employer but also for Bill himself and the people he supervises.

Bill's latest is the setting up of a department that he calls "Central Toolroom Grinding". In this separate department he installed tap grinders, drill grinders, cutter sharpeners, cutting tool grinders, and other grinding machines.

The machines that Bill chose were those that were the easiest and quickest to operate—those that did an accurate job with the least need for skill. By doing this, Bill insured the attainment of maximum grinding efficiency with less-skilled help. About one-half of the staff in this special grinding department are girls and women.

The way Bill's idea works, of course, is that, whenever practical, all tools in the plant that require grinding are sent to "Central Toolroom Grinding". Also all tools that are broken, or considered to be worn out. C.T.G. does the "scrapping" for all tools in the plant. Of course, many tools are thus salvaged for use in other departments on jobs having a wider tolerance range.

Bill's idea has worked out very profitably. Although his plant is only medium-sized, Bill's brain-child has shown a saving in excess of $50,000 in the first year of operation.

Bill may have been using a little Dale Carnegie when he told me that he gives a large share of the credit for the success of his idea to the use of Blake sharpening equipment—but he *did* buy our products: Blake Tap Grinders, Black Diamond Precision Drill Grinders, and Waltham Cutter Sharpeners. (Incidentally, he told me he's putting through an order for a Blake Flute Grinder.)

Perhaps you too, in a small or large way, can set up a Grinding Room—to your and your company's profit. We of the Blake organization would be more than willing to help you in every possible way—for saving our customers' money is our business. To make it easy for you and us just check the items below in which you're interested—and mail us the coupon.

One of the Omars (to give him his full name: Omar Ibn Al-Halif) has said: "Four things come not back:The spoken word; the sped arrow; time past; the neglected opportunity".

So—*before* you turn the page—cut out the coupon *now*—and mail it soon.

EDWARD BLAKE COMPANY
634 Commonwealth Ave., Newton Centre 59, Mass.

Yes, Ed, I'm interested in saving money with modern sharpening equipment. Send me the story on the units checked below:

☐ Blake Tap Grinders
☐ Blake Flute Grinder
☐ Black Diamond Precision Drill Grinder
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Super - Sensitive Fixed Center Multiple Drilling Heads

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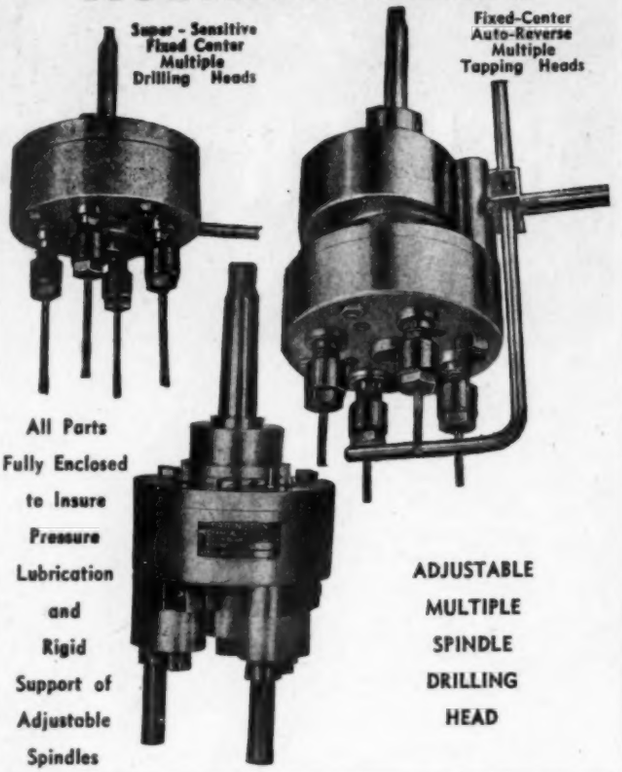

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H&G DIE HEAD

See our Advt. on page 358 Jan. 16, '47 American Machinist

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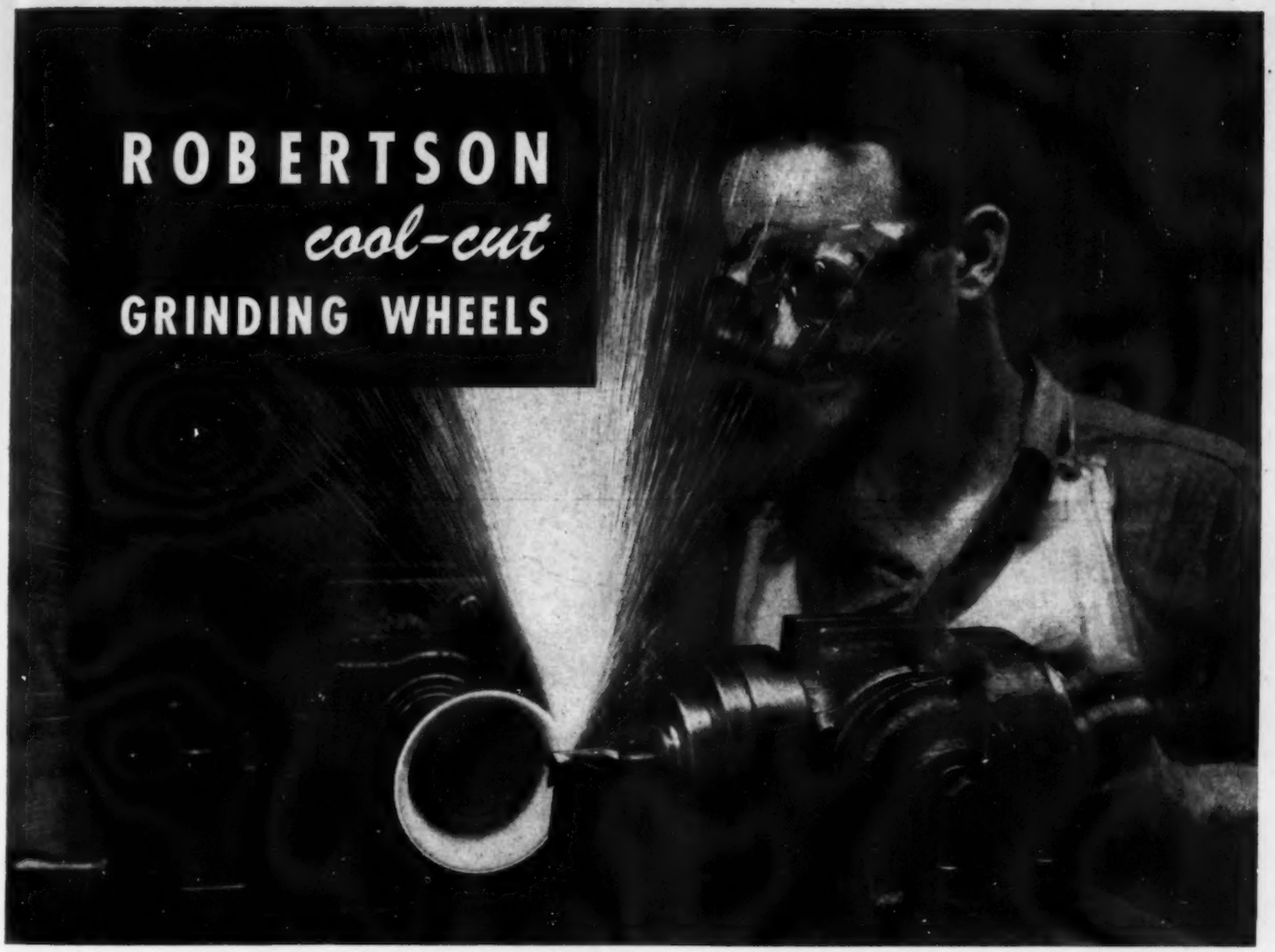

Unretouched photo of Robertson Flaring Cup Cool-Cut in action in precision-tool manufacturing plant. (Name of plant on request.)

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FOR PRECISION PERFORMANCE

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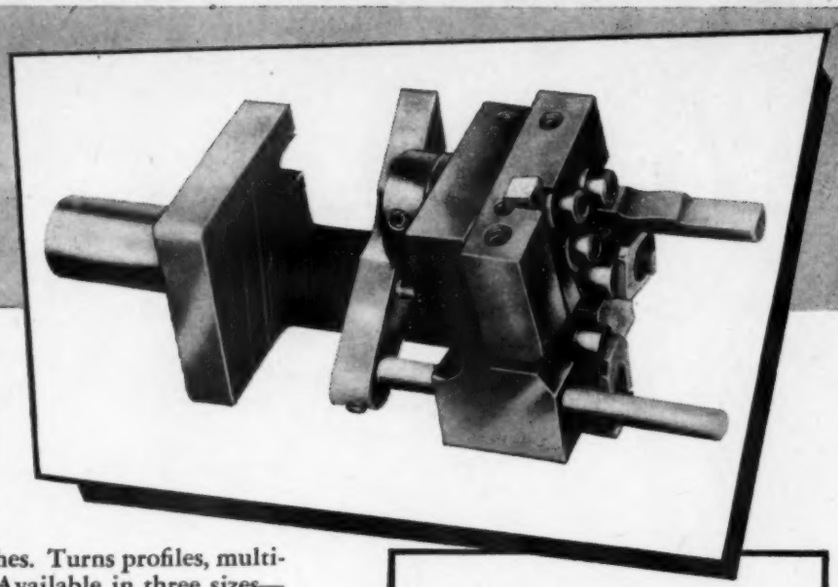

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Colored Collets identify plug instantly. Weight is reduced, Plugs securely locked without marring or scratching plugs as with metal collets.

New Light Weight Handle with these collets.

DUBLIFE

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Favorite for burring, finishing and polishing on the widest variety of metals and metal parts.

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Tougher texture, for finishing hard metals. The tougher binder accents the abrasive action, yet retains the soft rubber cushion, finishing and pre-polishing in one operation.

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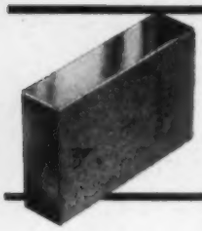
WELDON ROBERTS Brightboy

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark 7, N. J.



Send us your gage blocks for a complete measurement check

PROMPT RETURN

Take advantage of Dearborn Gage Company's complete inspection service for all types of gage blocks. Just send your gages to us and they will be inspected immediately and returned to you within 10 days from the time received by us.

Accurate calibrations are made (after the removal of high spots or burrs) in our temperature controlled inspection room, at 68 degrees Fahrenheit.

Where gage blocks are not badly worn and a more complete calibration is required, end and center measurements are made on rectangular type gage blocks and at the center of each side of square blocks.

CHARGES

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THE "W" (OR WORKING) CHECK: Twenty-five cents for each block smaller than one inch and twenty-five cents for each additional inch or fraction thereof.

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When you send in your gage blocks for inspection it is very practical to give us specific instructions to replace any of your gages which we find to be worn beyond a certain tolerance. This specific tolerance is, of course, to be determined by you. You may also wish us to replace certain gages which have become damaged in some manner.

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Certificate of Inspection

Reproduced above is a sample of a certificate of inspection, stating the specified size of each block measured and the actual measurement or variation from normal size.

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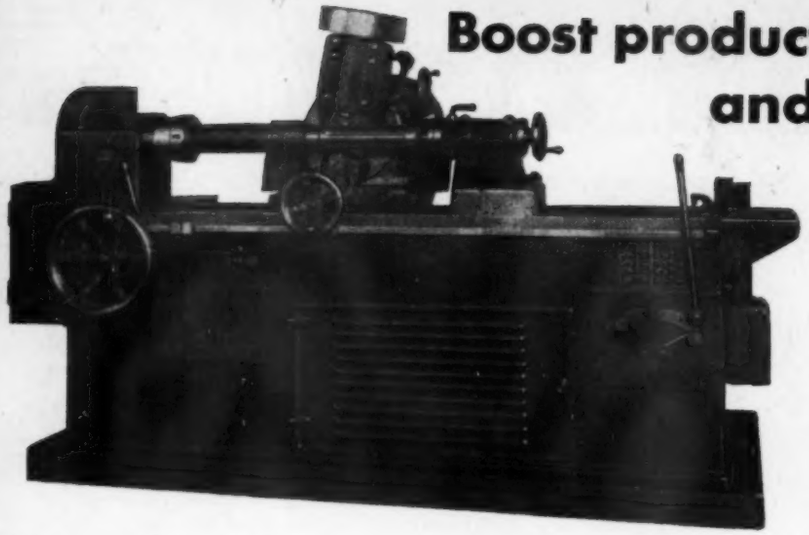

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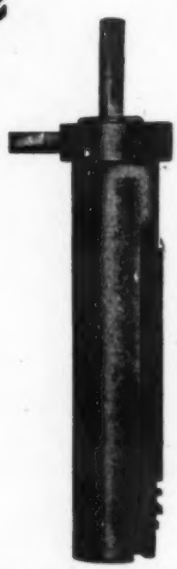

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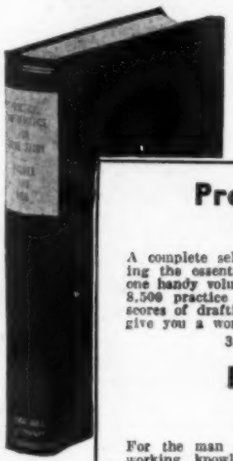

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(Continued on page 233)

WANTED—SHOP SUPERINTENDENT
Well established company in Boston area manufacturing industrial equipment seeks man with successful record as head of Metal Working Department. Knowledge of modern shop practices and planned production essential. Under fifty. Give complete details. Reply to:
P-893, AMERICAN MACHINIST
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P-897, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

POSITIONS VACANT

(Continued from opposite page)

WANTED: Experienced Design Engineer to design precision machines and equipment for rebuilding internal combustion engines, principally automotive. Excellent opportunity promising permanency and advancement offered by progressive, old-line company in middle-west. Write today giving complete personnel history enclosing recent photograph or snapshot. All information confidential. P-838, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MACHINE TOOL Painter with experience wanted by middle-west shop. Apply by letter giving age and qualifications. P-885, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

AUTOMATIC LATHE Supervisor. Exceptional opportunity for qualified man with established Connecticut manufacturer of quality machine products. Must have thorough knowledge Cleveland Automatic Lathes, methods, set-ups, tooling; ability to supervise Department. Give complete information, past experience, age, etc. P-900, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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SW-892, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

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This set up includes property, building, & all equipment and will bear investigation. If interested write,

BO-898, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

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5½" Cleveland Model A, single spindle.
16" x 33" Fay Automatic Lathe.
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4' Canedy-Otto Radial Drill. New in 1946.
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No. 314 Baker, single spindle.
★ 28" Cincinnati-Bickford Super Service.
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Model A Barber-Colman Gear Hobbers.
No. 3 and No. 12 Barber-Coleman Gear Hobbers.
No. 61 Fellows Gear Shaper, m.d.
No. 715 Fellows Gear Shaper, m.d.
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No. 72A3 Heald Sizematic Int. Grinder.
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★ No. 2 Cincinnati Centerless Grinder, with hydraulic profile wheel truing attachment, through feed rest, Filmatic bearings; motor driven. New in 1942.
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12" x 30" Pratt & Whitney, g.h.
14" x 6' Sebastian, motor in base.
16" x 6' Hendey, g.h.
17" x 6' LeBlond Regal, g.h.
18" x 12" Lodge & Shipley, g.h.
48" x 12' Lodge & Shipley, C.D.
IMP and LR Lo-Swing, m.d., new in 1940.
15" x 30" Lipe Carbo-matic, new in 1943.

LATHES, TURRET

No. 3A Warner & Swasey, g.h.
No. 1A Warner & Swasey, g.h., new 1943.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 5 Warner & Swasey, Universal, g.h.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 1 Bardons & Oliver, c.d.
No. 1 Brown & Sharpe, m.d.
No. 6D Potter & Johnston.
24", 36", 42" Bullard VTL, New Era.

MILLS

No. 4A Brown & Sharpe Universal, s.p.d.
No. 3 Cincinnati Univ., motor in base.
No. 2 Cincinnati Univ., motor in base.
No. 2H Milwaukee Plain double overarm, motor in base.
No. 2-MH Cincinnati Plain, m.d.
No. 2H Milwaukee Vert., motor in base.
No. 2209 Milwaukee, Table 22" x 158".
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.

MISCELLANEOUS

No. 17 Greenerd Arbor Press.
No. 100 Micromatic Hydrohoner.
No. 1 Standard Drop Hammer.
12' x 3/16" Bertsch Combination Punch and Shear, m.d.

PLANERS AND SHAPERS

16" Gould & Eberht. Crank Shaper, m.d.
★ 6" Pratt & Whitney Vertical Shaper.
36" x 36" x 12' Liberty Planer, 2 heads, box table.
42" x 42" x 20' Cin. Planer, D.C. Rev. m.d.

TAPPERS

No. 2BG Garvin.
Leland-Gifford Radial.

2⅝" RA-6 Acme-Gridley Automatic Screw Machine, with bar feed rack collets, chip conveyor, motor and control. New in 1943.
14" x 60" Mattison Surface Grinder motorized, with hydraulic unit, coolant equipment, wheel truing attachment, motors and controls. New in 1943.

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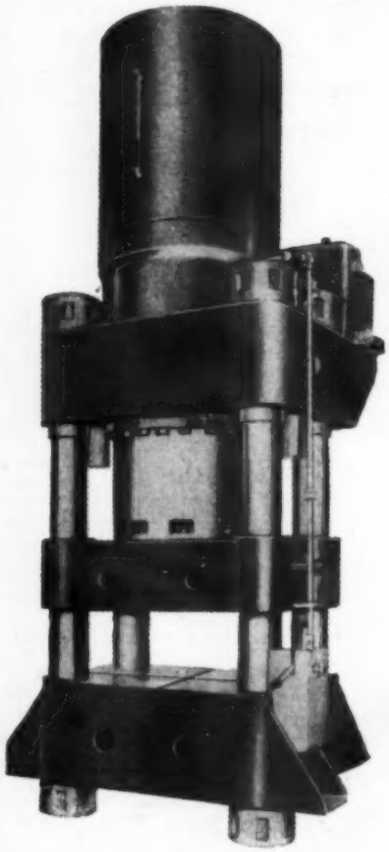

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16"x24"x72" Mattison Surface Grinder
6x30 Norton Type "C" Plain Grinder, Hydraulic, with Oscillating Wheel Head
8' x48" Jones & Lamson Automatic Thread Grinder
#1 Brown & Sharpe Universal Cylindrical Grinder
#1-18 Cincinnati Plain Miller
#3 Cincinnati Dial Type Vertical Miller
6" Pratt & Whitney Vertical Shaper
#3 and #5 Jones & Lamson Turret Lathes
#3 and #4 Warner & Swasey Turret Lathes
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2—#00 Brown & Sharpe Full Automatic, Standard Speed

1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle

1—#515 National Acme 9/16" 4-spindle Automatics, complete

LATHES

10"x24" Logan Q.C.G. Lathes (new)
Sebastian Engine Lathes (new)
13"x6' Williard, geared head
14"x6' Hendey Yoke Head
14"x6' Rockford Cone drive (two)
16"x6' American Motor Driven Lathe
16"x8' Lodge & Shipley 12-speed Grd. Hd.
18"x10' American, Geared Head, Taper
20"x10' Hendey with Taper
20"x11' Schumacher-Boye, M.D.
24"x12' LeBlond Heavy Pattern
24"x24" American Lathe, motor dr.
26"x18' Bridgeford geared head
28"x10' Davis cone driven
32"x16' Bridgeford geared head
48"x30' Simmons Geared Head, 1941

TURRET LATHES

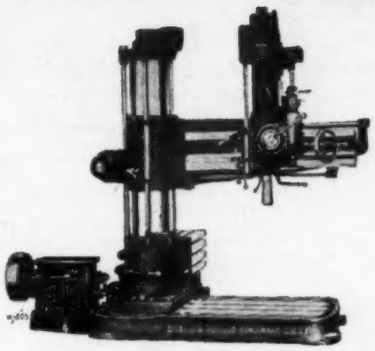
4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive
2—#4 Warner & Swasey Universal Turret Lathe, Motor Driven
16" Warner & Swasey Brass Lathe
#2A Warner & Swasey Universal
#3R Gisholt Universal like new
#4 Foster GFH Hand Turret Lathe
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)
Bullard 42" Vertical Turret Lathe

TURRET PUNCHES

Hecker, vertical type, 8-station, air operated, 18" throat

PLANERS

20"x20"x24" N.B.P., Planer Shaper
26"x26"x8' Gray Planer, 2 heads



RADIAL DRILLS

3½' Arm, 10" Column Cincinnati-Bickford
4' Arm, 11" Column Cincinnati-Bickford
5' Arm, 13" Column Cincinnati-Bickford
5' Arm, 14" Column Fosdick, motor drive
6' Arm, 15" Column Cincinnati-Bickford

Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

FOUNDRY MOULDING MACHINES

2—#0 Johnston & Jennings, Jolt Squeezer Draw Pattern, 15" x 21" Table

3—#342 Osborn Jolt Rollover Pattern Draw Moulding Machines, 23"x38" table

2—SPO Hand Rollover Power Draw Moulding Machines complete with run-out cars 22½"x60"

SHEARS & METAL WORKING

Lennox Splitting Shear ¾" cap.; 8' throat
Lennox Bevel Shear, ¼" cap.
Peckstow 30"x18 ga. Squaring Shear
Niagara 48" Roller Leveller, 6 Rolls
West Co. 36" x 16 ga. 15" gap, Power Squaring Shear

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
#1 Brown & Sharpe Plain Miller
P & W 2½" Duplex Spline Miller
Thread Miller, Hall Planetary #1—24"
#8 Lees Bradner Thread Miller
#1, #2 Kempsmith Plain Millers
#3B Hendey Universal Miller, motor drive
#4 Cinn. Vertical High Power Miller. (2)

MISCELLANEOUS

15 KVA Ace Spot Welder, 18" throat
Toledo Spot Welders, 10 K.W., 15 K.W.

GRINDERS

Queen City Dble. End Grinders, new
#33 Abrasive Vertical Surface motor drive
#3 Abrasive Horizontal Surface
12" No. 22 Heald Rotary Surface Grinder
16" Persons-Arter Rotary Surface Grinder
1—Gardner Dble. Opposed Grinder #14
1—Seybold 96" Knife Grinder
Oliver of Adrian Drill Grinders
Cincinnati Centerless Grinders #2 M.D.
#12 Greenfield Internal Hydromatic Grinder, sizematic type
#2 Brown & Sharpe Surface Grinder
#70 Heald Internal Grinder
#60 Heald Cylinder Grinder
10"x18" Norton Cylindrical
2—Cincinnati, #1½ Tool & Cutter Grinders

BORING MILLS

3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36

#31 Lucas Horizontal Boring Mill, 3" bar

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M.T.

POWER PRESS HEADQUARTERS

Famco Arbor & Foot Presses (new)
2—#1A Standard Bench Type Press, ¾" stroke
#4 Bliss D. C. Forging Press
200 ton A.C.F. Hydraulic Press. Bed. 24"x36", 4-post.
Hilles & Jones #4 Single End Punch and Shear. Equipped as Plate Shear with 18" Blades. ARR, motor drive, 48" throat

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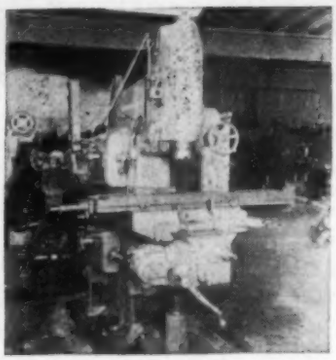
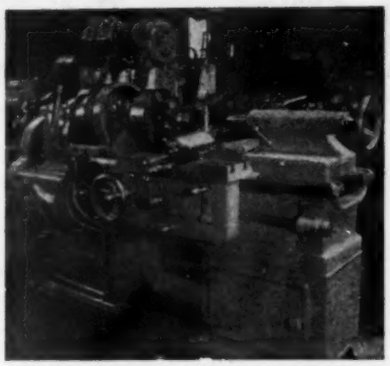


Cincinnati #2 vertical miller $1000.

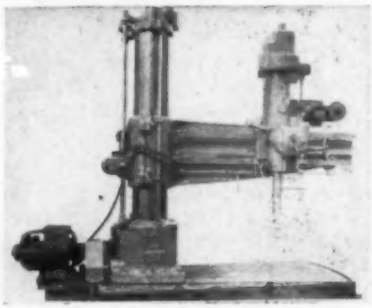
Acme Gridley RB6, 2⅜", RA8, 1⅝", RA6, 1⅜", RA6, 1¼", RA6, 1", RA6, 9/16".
New Britain Gridley Models 60 and 61, 2¼", 1⅝", 1", 23A Chucker.
Conomatic 6 spindle 2⅜", 4 spindle 6", 4 spindle 2⅜", Cut Off.
Cleveland single spindle 5¾".
Goss & DeLeeuw 5 spindle 8".

Other Late Type Machines

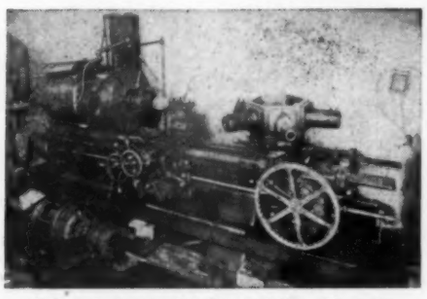
Farnham Forming Roll (new) cap. 1515 EXX ½"x15' $7237.
36/72 "Cincinnati Horizontal Hydrotel Milling Machine 1942 now $6218. cost new $27,000.
Warner Swasey & Gisholt 1942 #3 & #4 Turret Lathes with bar att.
Bryant internal grinder 24x36 (1942) Lees Bradner Thread Miller 12x36 (1942) Barber Colman #3 Precision gear hobbers (1942) Racine 12" hydraulic cut off saw (1942) Bullard Multaumatic 6 spindle 12" $3000 (REBUILT) Large Lathes.



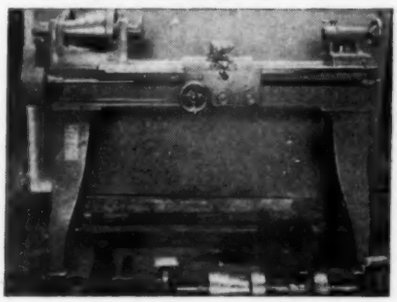
Syracuse 15"x36" D.C. motor, gear box, $500.



Cincinnati Bickford 6' radial drill D.C. motor drive. $1350.



Warner & Swasey 3A Turret lathe with motor. $1400. serial 322787



10 Reed 12"x5' and 6' lathes, hollow spindle, $250. and $300. each.

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Drill, #25 Foot-Burt motor driven
Drills—New—18" Royal Motor driven (10)
Gear Cutter, Brown & Sharpe #3—26
Gear Cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive
22" **Buffalo** Pr. Fd. Motor Drive, New
16"x6' **Hendey Lathe,** Quick Change Gear
Magic Chucks #1-2 & 3 and Collets
Pipe Machine, 3" Oster motor drive
Planer, 24"x24"x6' Pease motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathe, and 3 milling machines, plain and Uni. Tell us definitely what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

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BOLT CUTTERS, No. 22 Murchey, Dble. Hd.
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BORING MILL, No. 0 G & L, 3½" bar.
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BORING MILL, 36" Bullard, "New Era".
BORING MILL, 42" King, Tur. & Side Hds.
BORING MILL, 60" N-B-P, 2 heads, M.D.
BORING MILL, 40" King, 2 heads, M.D.
BROACH, Hr. Hyd. XA Oilgear, 60" stroke.
BROACH, Vert. Hyd. SRV5-42" LaPointe.
DRILL, Hvy. Duty, No. 513 Baker, No. 6 M.T.
DRILL, Radial, 6' Cinc.-Bickford, M.D.
GEAR SHAPER, #75 Fellows, M.D.
GRINDER, Internal, No. 72A5 Heald, 2 Mtr.
GRINDER, Plain, 24"x240" Norton, M.D.
GRINDER, Surface, No. 5 Abrasive, 14"x48".
HAMMER, Board Drop, 1,000#, B. & S.
HOISTS, Monorail, 3 ton, Detroit
KEYSEATER, No. 2 Mitts & Merrill
LATHE, 22"x8' L. & S. Sel. Grd. Hd.
LATHE, 24"x10' L & S, Sel. Grd. Hd.
LATHE, 36"x22' N-B-P, Grd. Hd., Q.C.G.
LATHE, 38"x19' Putnam, Grd. Hd., Q.C.G., T.A.
LATHE, 42"x50' Putnam, Grd. Hd.
MILLER, Duplex 24" Cincinnati, Auto.
MILLER, Plain, Nos. 3S, 4 & 5 Cincinnati.
PUNCH, Beam, L & A, Size "A", cap. 24" beams
PUNCH & SHR., No. 15 W & W. Dble. End.
SHAPER, Vert. 10" Pratt & Whitney.
SHAPER, 24" Steptoe, AC, M.D.
SHEAR, Bar, No. 3 United, Open End, M.D.
SHEAR, Plate, 132"x1½" Morgan, 26" thr.

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BROWN & SHARPE #5 Plain 3x12, LATEST
BROWN & SHARPE #20—Plain—10x18—Latest Type
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NORTON 10x18 Plain—motor drive
NORTON 10x36" Plain Type C, Hyd., latest type
NORTON 16x72 Plain, Type C—latest type
NORTON 16x72 Universal, HYD., Multi-purpose, Latest Type

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BROWN & SHARPE #16, Universal Tool, Latest Type
BRYANT No. 1 —16" Chucking—Internal—latest
BRYANT #5 Internal, hyd., latest type
CINCINNATI #2, #3, #4 centerless, LATEST TYPE
FITCHBURG Uni., spline shaft, hyd.
GLEASON #12 cutter grinder
HEALD 72A3 Plain Internal, latest type
HEALD 72A3 Sizematic Internal, latest type
HEALD 72A5 plain internal, latest type
LANDIS #1 Race-Way, Latest Type
OLIVER Tool and Cutter, Latest Type
PRATT & WHITNEY Contour Cutter—latest type
SELLERS #1 Tool—Motor Drive
SELLERS #2 Tool—Motor Drive
SELLERS #4T Uni., Tool—latest type

GRINDERS—Surface

ARTER 30" Rotary Surface—Hydraulic—latest type
ARTER Automatic Piston Ring
BLANCHARD #16A—Dial Type—motor drive
BLANCHARD #16, 26" Chuck, Motor Drive
BLANCHARD #27—42" Chuck—Latest
HEALD #22, 12" Rotary, Latest Type
MATTISON 12x16x48 Hyd., Latest Type
MATTISON 14x16x36 Hyd., Latest Type
MATTISON 14x16x60 Hyd., Latest Type
NORTON 10x36 Hyd., Latest Type

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AMERICAN 36x25' centers—Timken Bearing—2 carriages P.R.T. Taper Attachment—Latest Type
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HARDINGE 9x54" bed, QCG, Cataract
HENDEY 14"x8' bed geared head
HENDEY 22"x8' bed, geared head
HENDEY—12x54 centers—latest type
HOUSTON, STANWOOD & GAMBLE 36x24' bed
LeBLOND 13"x4' bed, Timken Mfg.—latest
LOSWING 4x60", 4x84", 8x60", 8x84", Timken Bearing, Latest Type
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NILES 48x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
NILES 60x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
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RIVETT #698—6"x18" Centers

LATHES—Turret

BARDONS & OLIVER #5, #7 Timken Bearing—latest type
CINCINNATI ACME #1, #5W, Timken bearing, latest type
GISHOLT #3D Simplimatics—Timken—latest
GISHOLT #1L, #2L, #3L, Universal, Timken Bearing, Latest Type
GISHOLT #4L, 9" hole—cross sliding turret—Timken Bearing—latest type
JONES & LAMSON #3, #7C Univ., latest type—Timken Bearing
LIBBY #1H-5 Timken Bearing—latest 5½" hole
MOREY 2G, #3, #4, Timken Bearing, latest
WARNER & SWASEY #2 Timken, latest
WARNER & SWASEY #4A—uni. 8" hole, timken bearing, Latest Type
WARNER & SWASEY #3, 4, 5, Universal, Timken, Latest

MILLING MACHINES—Mfg.

BRIGGS Type 2A, production, HYD, latest type
BROWN & SHARPE #000—Timken Bearing, Latest Type
BROWN & SHARPE #12 auto., Timken—latest
CINCINNATI #0-8 Vert.—Pl. Auto.—Timken Bearing —latest type—Rise & Fall
CINCINNATI 48" duplex, automatic, SPD
KEARNEY & TRECKER #1218 Auto.—Timken Bearine—latest type
MOREY #12M 2 spdle, Profiler & Milling Machine
NICHOLS Hand, M.D.—Latest Type
OHIO Auto. 16"x72" table—Timken Bearing
TAYLOR & FENN M-80, Duplex Spline, Latest Type

MILLING MACHINES—Plain

BROWN & SHARPE #2 Light Type, Timken, Latest
CINCINNATI #3 High Speed, Dial Type, Timken Bearing, latest type
CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #4S, #5, high power, M.D.
KEARNEY & TRECKER #3K—Timken—latest
KEMPSMITH #4 Maximiller—Timken—latest

MILLING MACHINES—Univ.

AMES Bench, Timken Bearing, latest type, M.D.
CINCINNATI #2, Motor Drive
CINCINNATI #2, Dial Type, High Speed, Timken, Latest
VAN NORMAN 22L, Timken Bearing, Latest Type
HARDINGE Bench, Timken Bearing, Latest Type

MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI #2 Dial Type—Timken—latest
CINCINNATI #3, #4 High-powered, Motor Drive
CINCINNATI #4, High Speed, Dial Type, Timken, Latest
KEARNEY & TRECKER 2H, 2K, 3H, 3K, 4H, 4K, Timken—latest

PLANERS

CINCINNATI 48x48x20', 3 heads, AC M.D.
CHANDLER 36x36x20' 4 heads AC, M.D.
CRAVEN 144"x96"x30', 4 heads, DC, M.D. Latest Type
DETRICK & HARVEY 48x48x16', 4 heads, Hyd.
DETRICK & HARVEY 48x48x12 Openside, AC, M.D.
LYND FARQUHAR 26" Openside, motor drive
NBP 54x54x12', 2 heads, box table, AC, M.D.
NILES 48x48x12'—Time Saver—3 heads, P.R.T., box table, DC, M.D.—latest type
NILES 48x48x16', 4 heads, AC, M.D.
OHIO 42x42x20'—2 heads, AC
POND 48x48x16' 2 heads, AC, M.D.

SAWS

BRIDGEPORT #48W Abrasive
ESPEN LUCAS #138—Cold Saw, M.D.
GROB 08-20—band and filing—Latest Type
PEERLESS 14x14 Hack: latest type

SHAPERS

CINCINNATI 24" Crank—Motor drive
CINCINNATI 26" Travel Head—2 head Type B
COCHRANE BLY Univ. Vert. Shaper-Miller, M.D.
LAMAIRE 18' Vert. Hydraulic—latest type
MOREY 8", 10", 12", 14", Vertical, Latest type
NEWTON 15" vert. slotter, D. M.D.
NILES 18" ver. slotter, DC, M.D.
PRATT & WHITNEY 8', 10", Vertical, Motor Drive

THREAD MILLING MACHINES

HALL—Planetary, M.D.—Latest Type
HANSON & WHITNEY 4 x 9, Latest Type
MOREY SHIELDS 12x120, 12x192—latest type
PRATT & WHITNEY 4½x12, Model "C"—Latest
PRATT & WHITNEY 6x132—Motor Drive
PRATT & WHITNEY 6x20 Model "C"—Latest
SMALLEY General #20 MB, Motor Drive

AUTO. SCREW MACHINES

BILLINGS & SPENCER B-2 Diametic—Latest
CLEVELAND ⅞" to 2½" Model A
CONOMATICS 3½" 4 spindle—latest type
CONOMATICS 2½"—6 spindle, Latest Type
NATIONAL ACME 9/16" mod. C, 5 spdle., M.D.

BORING MILLS—Horizontal

DETRICK & HARVEY—5" bar—floor type—motor drive
FRANKLIN 4½" bar, single pulley drive
LANDIS #35—3½" bar—floor type
LUCAS #33—4½" bar, motor drive
NILES BEMENT POND 5", 6", 7" bar—floor type
OHIO #5F-420 5" bar, floor type, latest type
P & H #10, 3½" bar, floor type, M.D.
UNIVERSAL #40—4" Bar, Motor Drive

BORING MILLS—Vertical

BETTS 120"—2 swivel heads, motor drive
BETTS (Consolidated) 100"—2 heads, DC, Latest type
BETTS (CONSOLIDATED) 84" 3-heads, DC Latest
BULLARD 24", 36", New Era Type, M.D.
BULLARD 42", Spiral Drive, latest type
BULLARD 86"—2 swivel heads, motor drive
CINCINNATI Hypro 84" 3-heads, AC Latest Type
COLBURN 72" 2 swivel heads, AC, M.D.
KING, 30' Vert., M.D.
KING 36" Motor Drive, Latest Type
KING 60" 2 swivel heads PRT AC, M.D.
NILES 40"—2 swivel heads, power rapid traverse
NILES 73", 2 swivel heads, PRT, AC, M.D.

DRILLS

BAKER #121 Single spindle—latest type
BARNES #H3, Hydram, latest type
BARNES #210—single spindle—latest
BODINE 42-20, 42-30 automatics—M.D.
COLBURN #14, 2 spindle heavy duty, AC, M.D.
EDLUND #1B, #2B, #2MS, M.D.
FOOTE BURT SIPP #2, #3—single spindle—latest
HENRY & WRIGHT 2 spindle
PRATT & WHITNEY No. ½Bx50" 2 spindle. Deep Hole latest type

DRILLS—Radial

AMERICAN 3½'9"—Maxi-Speed, Motor Drive
AMERICAN 4'11"—5'11"—5'13" AC, M.D.
AMERICAN 7' Triple-purpose, M.D.
AMERICAN 3'11", hole-wizard, Latest Type
CANEDY OTTO 3'11" New
CARLTON 4'13", 5'14", 6'15"—M.D.
CINCINNATI BICKFORD 4'13", 6'19"
DRESES 5'13", AC, M.D.
DRESES 5'15" Universal, AC, M.D.
FOSDICK 5'14", AC, M.D.
MUELLER 4½'9", AC, M.D.
NILES BEMENT POND 6'15" uni., AC, M.D.
RYERSON 4'11" AC, M.D.
WESTERN 3', 4'18", 5'18", 6'20", latest type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber—latest
BARBER COLMAN Type S, #3, #12 Hobber, M.D.
BROWN & SHARPE #3H gear cutter, M.D.
FELLOWS #7, #7A type, all models, latest
FELLOWS #6, #6A type, all models, latest
GLEASON 6", 11", 18" bevel gear generator, M.D.
GLEASON #13 tester, M.D.
GLEASON 15" Quenching Press
GLEASON 24" Bevel Gear Planer
GOULD & EBERHARDT 12 H.S., Latest Type
GOULD & EBERHARDT 18H Hobber with in-feed, differential, M.D.
HERCULES 24" HOBBER, differential, M.D.
PRATT & WHITNEY 10" Grinder, hyd.—latest type
AMERICAN MACHINIST—6913—March 27

MISCELLANEOUS

BARNES #420 2-spindle deep hole Drill—Hyd.—Latest Type
BAUSH Radial Tapper—latest
BILLINGS & SPENCER, 200, 400, 800 lbs. board drop hammer, latest type
CASCADE #120 Industrial deep freeze
FERRACUTE No. DG55, Drawing, latest type
GENERAL ELECTRIC 100KW Generator
LaPOINTE #3L Broach, horiz. hyd. 15 ton cap.
LeBLOND #2 deep hole borer, latest type
MORTON 60" combination travelling head planer, milling and drilling, motor drive.
NILES 30"x50' deep hole borer, Timken—latest
PRATT & WHITNEY 2A Jig Borer, Latest Type
PRATT & WHITNEY 3-B Jig Borer—Latest type
SHUSTER #1 Wire Straightener
TREADWELL 12"—Pipe Threader—Motor Drive
WHITON 8x108 centers duplex centering, M.D.
YATES AMERICAN J-70, Woodworking Lathe, latest
YODER Multiple tube cutting machine—latest

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CLOSEOUTS

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#OG&L Spd.
2½" Cleveland Spd.
2½", 4" Binsee
66" Niles
54" Colburn, M.D., 2 hds.

TURRET LATHES

Foster Nos. 4, 5, 6, 1B, 3B M.D. Univ.
J. & L. 2½"x24", 3¼"x36".
Acme #2 M.D.
No. 1L, 2L Gisholt Univ. M.D.

GRINDERS

P. & W. 14", B.B., Vert. M.D.
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 72A3 Gagematic
Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
No. 55, 60, 65 Heald int. Hydraulic, M.D.
12" Heald Rotary Arter 12" M.D.
B. & S. No. 2, 2B Surface, M.D.
B. & S. No. 10 1 Cyl.
No. 2 Cincinnati Centerless M.D.
B. & S. No. 1, 3 Universal
#25, #55 G. & L. M.D.
#25A Heald, M.D.

LATHES

10"x3' South Bend, M.D.
Monarch geared head
McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone B.D.G.
14"x6', 16"x6' Hendey
9" LeBlond Automatic
36x30' Putnam M.D.
36x22" Putnam, D.C. M.D.
32"x35' Wickes
Putnam 42x16', M.D. S.C.G.
P. & W. 1x18, Automatic Lathes

AUTOMATICS

Cleveland Model A ½", ⅞", 1¼", 2"
Cleveland Model B 1", 2"
P & J 6A, M.D.
⅞" Cone 4 spindle

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RADIALS

4', 5', 6' American Triple Purpose
4', 5' Cincinnati-Bickford
4' Muller, M.D.; 4' 5' Western, S.P.D.
4' Fosdick

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No. 3S Cincinnati, S.P.D. rapid trav. M.D.
Nos. 1Y, 0Y, 3, 4, 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6, Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 2, 30 Profiler M.D.
K. & T. B. & S., No. 2, 3 like new
B. & S. No. 1, 3, Vert.
No. 3D, Gorton Vertical, M.D.
#3 Van Norman Universal
#2 Conradson Universal
#22L Van Norman Univ.

MISCELLANEOUS

Gorton No. 1S Engraving Machine
6 spindle Avey Drill 15" overhang
Rochester No. 5½" B Hammer
6" Vertical Shaper P & W
Oster Pipe Machines, 4", 6", M.D.
N.B.P. 15" Slotter M.D.
10x10 Peerless Universal Shaping Saw
#7 72 Fellows Gear Shapers
Lennox Throatless shear ¼" cap., M.D.

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#25-C DEFIANCE Table Type, M.D.
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#560-F GIDDINGS & LEWIS, Floor Type, M.D.

GRINDERS

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#72A3 HEALD Plain & Sizematic, M.D.
#5 B & S Plain Grdr., M.D.
4"x12" LANDIS Type H Plain, M.D.
12"x48" NORTON Type "C" Multipurpose Universal, M.D.
14"x168" NORTON Type "C" Plain, M.D.
#4T SELLERS Tool Grdr., M.D.
8" P & W Hyd. Gear Grdr., M.D.
#11 BLANCHARD Rotary, 16" & 20"
#81 HEALD "Gage-Matic" & Size-Matic", M.D.

LATHES

18"x72" MONARCH 8-Speed Geared Head
42"x132" AMERICAN "SUPER PRODUCTIVE", M.D.
50"x17' centers LEBLOND "BIG SWING", M.D.

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#1H-12 K & T Mfg., M.D.
#2HL K & T Plain, M.D.
#8½D GORTON Univ. "SUPER SPEED" Vert., M.D.
#M-50A TAYLOR & FENN Vert., M.D.
#2MS CINCINNATI Vert., M.D.
#3MS CINCINNATI Vert., M.D.
#3HS CINCINNATI Vert., M.D.
#3K K & T Vert., M.D.
#4 CINCINNATI "Hi-Power" Vert., M.D.
#5H K & T Plain Heavy Duty, M.D.
#5/60 CINCINNATI Duplex Hydromatic, M.D.
#12-M MOREY 2-spdle PROFILER, M.D.

PRESSES

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New HUB 15 ton OBI, M.D.
New U. S. Press, 12 ton, M.D.

RADIAL DRILLS

4'9" CINCINNATI BICKFORD "SUPER SERVICE", M.D.
4'11" CINCINNATI BICKFORD, M.D. thru gear box.
7'17" AMERICAN "HOLE WIZARD", M.D.

TURRET LATHES

#0 B & S Wire Feed Screw Machines, M.D.
#4 W & S Ram Type Univ., M.D.
#5 J & L Ram Type Univ., M.D.
#1A W & S Saddle Type Univ., M.D.

MISCELLANEOUS

#3120 NIAGARA Power Squaring Shear, 10' 10 gauge.
#36BM GOULD & EBERHARDT 3-spindle Gear Roughers.
#22 HEALD Rotary, 12" chuck, M.D.
6"x48" THOMPSON Broach Grinder.

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Rockford openside hydraulic shaper planer, 24"x24"x66", 3 heads, md, like new
Niles Bement Pond 4 head planer, 60x60x14, DC Drive
Niles Bement Pond 4 head planer, 96"x96"x20', DC Drive
Hendey motor in base lathe 14"x30", geared head
Sebastian (2) 14"x6' geared head lathes, md.
Vernon 12"x6' quick change lathe, md, taper attachment.
South Bend plain change lathe 14"x8'.
South Bend gap lathe 16"x24"x10'.
Putnam geared head Gap lathe 18"x36"x10', md.
LeBlond quick change lathe 17"x8'.
Hamilton semi-quick lathe 16"x8'.
Whipp 14" shaper with vise.
Smith & Mills 20" shaper, back geared, md.
New Brown & Sharpe #3B plain miller, 1 year old.
Cincinnati #5 plain milling machine, spd.
Cincinnati #3 plain millind machine, spd, md.
Cincinnati #3 plain milling machine, motor in base, 1942.
Landis 6x30 plain cylindrical grinder, type C hydraulic, 1942.
Landis 12x36 universal cylindrical grinder, type C hydraulic, 1942.
Cincinnati #2 centerless grinders, filmatic bearing.
Sellers #6G drill grinder.
Bullard "New Era" 24" vertical turret lathe, md.
Bullard 32" single head vertical boring mill, md.
Lees-Bradner #8 thread miller, 6" spindle, md, 1942.
Bliss 42"x14 gauge power squaring shear.
Long & Allstatter bar and plate shear, 2¼" bar - capacity, 20" blades.
Bement heavy duty plate shear, 14" blades.
Hydraulic car wheel press, 170 ton capacity, 6' dia. x 8' length.
Farnham pyramid type forming rolls, 15' length, 19 gauge cap., md.
Steever 6" pipe threading machine, md.
Morris 5' "Mor-Speed" Radial Drill, 1942.
Morgan (3) wire draw benches, 6 and 4 head, 12", 16", 20".
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#4 Warner & Swasey Universal, Preselector Heads, Tooling AC Motor Drive.

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3' American Sensitive, belt
3'-11" American Triple Purpose, m.d. on arm
3'-11" Carlton, m.d. on arm, latest
3' Fosdick Sensitive, s.p.d.
4'-11" American Triple Purpose, m.d. on arm
4'-11" American Triple Purpose, m.d. on base
4'-13" Carlton, m.d. on base
4'-13' Cincinnati-Bickford, m.d. on base
4'-13" Cinn.-Bickford Super-Service, m.d. on arm
4' Niles-Bement-Pond Semi-Universal, m.d.
5'-13" American Triple Geared, gear box on base
5' Cinn.-Bickford Plate Hole Driller, m.d. on arm
5' Prentice, m.d.
6'-15" American Triple Purpose, m.d. on base
6'-15" Carlton, gear box on base
6'-15" Cinn.-Bickford Super-Service, m.d. on arm
6'-15" Cinn.-Bickford with 7' arm, gear box on base
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-11" Western, m.d.
8'-16" American Triple Purpose, m.d. on arm
8'-16" American Triple Purpose, m.d. on base
10'-22" American Triple Purpose, m.d. on arm

HORIZONTAL DRILLS

No. ½Bx50" Pratt & Whitney Chambering Machine, m.d.
No. 1B-50" Pratt & Whitney Deep Hole, m.d., latest
No. 1 Pratt & Whitney 2 spindle Deep Hole, m.d.
No. 1½ Pratt & Whitney 2 spindle Deep Hole
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole, m.d., latest
Snyder Tool Co. Double End Boring Machine, m.d.
Pratt & Whitney Rifling Machine, belt
No. 420-2 spindle W. F. & John Barnes Deep Hole, m.d., latest
5 spindle Detroit Semi-Automatic, belt

UPRIGHT DRILLS

24" Cincinnati-Bickford, m.d.
28" Cincinnati-Bickford, belt
30" Rich H.D., m.d.
32" Aurora, belt
H3 Barnes Hydram, m.d.
D4, D8 Colburn H.D.
No. 25 Foote-Burt H.D.
No. 36HO Baker H.D., latest type

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1M Cincinnati, m.d.
No. 1A Milwaukee, m.d.
No. 1½, 2 Cincinnati, cone
No. 2B, 3B Brown & Sharpe, m.d. in base, p.r.t., latest type
No. 2L Cincinnati, m.d.
No. 2MH Cincinnati, m.d. in base, latest
No. 2 Cincinnati High Speed Dial, m.d. in base, latest
No. 3B Brown & Sharpe, m.d.
No. 3S Cincinnati, m.d.
No. 3 Kempsmith, cone
No. 4B Brown & Sharpe, m.d.
No. 4 Cincinnati H.S. Dial, m.d., latest
No. 4 Cincinnati H.P., m.d.
No. 4S Cincinnati, m.d.
No. 5B Heavy Brown & Sharpe, m.d.
No. 5 Cincinnati H.P., rect. overarm, m.d., latest
No. 5H LeBlond, m.d.

UNIVERSAL MILLING MACHINES

No. 3 LeBlond, m.d.
No. 2L Cincinnati, m.d. in base, latest
No. 3 Cincinnati, m.d.
No. 4A Brown & Sharpe, m.d.

VERTICAL MILLING MACHINES

No. 2M Cincinnati, m.d.
No. 2, 3, 4 Cincinnati H.P., m.d., flanged spindle
No. 2H Milwaukee Dial Type, m.d. in base, latest
No. 2K Milwaukee Dial Type, m.d. in base, latest
No. 2½B, 3B Milwaukee, s.p.d.
No. 3 Cincinnati, m.d. in base, Timken
No. 3V Van Norman, m.d., latest type
No. 3V Toledo, s.p.d.
No. 4 Cinn. H.P., m.d., National Standard, latest
No. 4H Milwaukee, m.d. in base, latest, dial
No. 4K Milwaukee, m.d. in base, latest, dial
No. 4 Milwaukee, m.d., dial
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 5 Reed-Prentice, m.d., circular attachment, latest type
No. 6 Becker, cone
No. 28-60 Cincinnati 2 spindle Vertical Hydro-Tel, m.d., latest

GEAR MACHINERY

Type A Barber-Colman Gear Hobber, m.d., long bed type, latest
Type A Barber-Colman, standard bed, m.d., latest
No. 3 Barber-Colman Precision Gear Hobber, m.d., latest
No. 3 Barber-Colman Standard Gear Hobber, m.d., latest
No. 12 Barber-Colman Double Overarm Gear Hobber, m.d.
Model T Barber-Colman Gear Hobber, m.d., latest
3" Gleason Straight Bevel Gear Generator, m.d.
8" Gleason Mfg. Type Straight Bevel Gear Generator, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical Gear Grinder, m.d.
11" Gleason Straight Tooth Bevel Gear Generator, m.d.
12" Gleason Straight Tooth Bevel Gear Generator, m.d.
No. 2HS Lees-Bradner Spur & Helical Gear Grinder, m.d.
No. 4—36" B&S Spur Gear Cutter, m.d.
No. 6—60" B&S Spur Gear Cutter, m.d.
No. 13LS Fellows Gear Lapper, m.d.
No. 34 Brown & Sharpe Gear Hobber, m.d.
No. 44 Brown & Sharpe Gear Hobber, m.d.
48" Cleveland Gear Hobber, m.d.
No. 7A Fellows High Speed Gr. Shapers, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 6, 61 Fellows Gear Shapers, belt
No. 61A, 615A, 645A3 Fellows Gear Shapers, m.d., latest
No. 64-S Fellows Gear Shaper, m.d.
Cincinnati Gear Burnisher, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
No. 96H Gould & Eberhardt Gear Hobber, m.d.

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d., latest type, new
No. 2 Cincinnati, m.d., pract. new, latest
No. 2 Cincinnati, m.d., older type
No. 3 Cincinnati, m.d., new, latest type
Cinn. Valve Seat Grinder, cap. ⅜" valve stems

CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., new, latest
No. 55 Heald, belt
No. 55 Heald, m.d.
No. 65 Heald, belt
No. 73 Heald Airplane Cylinder, m.d., new, latest
No. 6 Landis, belt

INTERNAL GRINDERS

No. 72A5 Heald, m.d., latest
No. 172 Heald Gap, m.d., brand new
No. 73 Heald Airplane Cylinder, brand new
No. 74 Heald, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A Heald Plain, m.d., latest
No. 49 Heald Single Borematic, m.d.
No. 24—21" Bryant Hydraulic, m.d.
No. 20 Bryant, belt
No. 16RS Bryant Hydraulic, m.d., latest
No. 16—22 Bryant Hydraulic, m.d.
No. 16A—16 Bryant, m.d.
No. 6 and 9 Bryant, belt
No. 9 Cincinnati, belt

MANUFACTURING LATHES

No. 9 Heavy LeBlond, m.d.
3½x36", 3½x80" Lo Swing
4x60" LoSwing, m.d., latest
8x84" LoSwing, m.d.
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9x12" Sundstrand Mfg.
9x14" Porter-Cable
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13x96" Automatic Threading
17"x6' LeBlond Automobile Mfg., cone
17"x8' LeBlond, cone
17"x8' LeBlond Rapid Production, m.d.
17x124" centers LeBlond Rapid Production, m.d. in base, latest
20"x8' LeBlond Mfg., m.d.
Niles-Bement-Pond Quartering Machine, new
No. 4 R. K. LeBlond Boring Lathe, 37' bed, 14' 4" boring length, 13" hole in spindle

VERTICAL BORING MILLS

24" Bullard, m.d., with side head
24" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret head, 1 swivel head
48" Putnam Heavy Duty, m.d., 2 swivel heads
53" Niles, m.d., 2 swivel heads
54" Colburn, m.d., 1 turret, 1 swivel head
84" Niles H.D., m.d., 2 swivel heads
100" Niles H.D., m.d., 2 swivel heads

BROACHES

Cincinnati Mill Broach, m.d., 10" spindle, new
Colonial Model VAS-5-42 Hydraulic, m.d., latest
No. 75 H.P. LaPointe Hydraulic, m.d., normal pull 37½ tons, max. stroke 150", latest
No. 4 LaPointe of Hudson, s.p.d.

BALL BEARING DRILLS

No. 2MA—6 spindle Avey, latest
Allen Bench Type, m.d.
No. ½, No. 1, and No. 2 Avey, m.d.
No. 1B Edlund, m.d., new
No. 3 Motor Avey, 12" overhang, latest
No. 5M—16" Fosdick, m.d.
No. 2 Henry & Wright, m.d.
No. 2 Leland & Gifford Hydraulic, m.d., latest
2 spindle Avey, m.d., AveyMatic Power Feed
4 spindle No. 2 Avey, m.d.
4 spindle Delta, m.d.
4 spindle Leland & Gifford No. 2 LMS, latest
6 spindle No. 3 MA6 Avey, m.d., latest

MULTIPLE SPINDLE DRILLS

No. 3 Baush, 16x30" head, m.d.
3 spindle 12" Rockford Gang, m.d.
4 spindle Foote-Burt Rail, m.d.
No. 16 Fixed Center Foote-Burt, m.d.

TURRET LATHES AND SCREW MACHINES

No. 1 Cincinnati Acme Semi-Universal, m.d., chucking
No. 1L Gisholt Universal, m.d., Timken Hardened ways, chucking
No. 1L Gisholt as above, long bed type
No. 1A Warner & Swasey Universal, preselecter head, latest type, bar
No. 1A Warner & Swasey as above, chucking
No. 1A Warner & Swasey, m.d., older types
No. 2 Cincinnati Acme Full Universal, m.d., chucking, latest
No. 2B Foster Universal, m.d., chucking
No. 2L Gisholt Universal, m.d., chucking, Timken, hardened ways
No. 2G Morey Ram Type, m.d., bar
No. 2 Warner & Swasey All Geared Head, m.d., bar, latest type
No. 2A Warner & Swasey Universal, m.d., bar
No. 2A Warner & Swasey, m.d., chucking
No. 2A Warner & Swasey, preselector head, m.d., bar, latest type
No. 2A Warner & Swasey as above, chucking
No. 3S Cincinnati Acme Fixed Center Universal, m.d., bar, latest
No. 3 Cincinnati Acme, m.d., chucking
No. 3 Foster Geared Head, m.d., bar
No. 3B Foster Universal, m.d., bar
No. 3 Warner & Swasey Universal, m.d., bar, latest
No. 3 Warner & Swasey as above, chucking
No. 3L Gisholt, m.d., chucking, Timken, hardened ways

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12"x18" Lipe Carbo, M.D.
18"x6' American Grd. Hd.
18"x48" Monarch, Keller attachment (1942)
22"x48" Monarch, (1943)
36"x30' Lodge & Shipley Triple Geared Selective Head, two carriages
42"x18' Putnam Geared Head
42"x30' American Grd. Hd.

MILLING MACHINES

No. 2H Milwaukee Vertical (1942)
No. 2 Cincinnati Med. Spd. Vertical (1942)
No. 3 Cincinnati Vertical
No. 3 Milwaukee Vertical M.D.
No. 3K Milwaukee Vertical
No. 4 Cincinnati Med. Spd. Plain (1941)
No. 4 Cincinnati Plain, Motor Drive
No. 118 Van Norman Production
24" Cincinnati Production
Taylor & Fenn Spline
No. 27MB Smalley General Thread
No. 2 Hanson-Whitney Thread
No. 6 Lees-Bradner Thread
24"x24"x12' Ingersoll Adjustable Rail
26"x25"x12' Ingersoll Adjustable Rail

DRILLS

D-8 Colburn Hvy. Duty
No. 2-8 Spdl. Leland-Gifford
3' Morris Mor-Speed Radial, 9" Col.
3' Morris Mor-Speed Radial, 11" Col.
4' Cinn-Bickford, 9" Col.
7' American full Universal Radial
7' Carlton, Motor on arm
7' American Hole Wizard, 17" Col.

VERT. BOR. MILLS

34" King
42" Bullard New Era Vertical Turret
72" Cincinnati
72" Niles Extra Heavy

HOR. BOR. MACHINES

3½" Bar Cinn-Gilbert, Table Type
No. 25-C, 3¾" Bar Defiance, Table Type
No. 360-F Giddings & Lewis
No. 560-F Giddings & Lewis

GEAR MACHINES

No. 7 Fellows Gear Shaper
12" Michigan Gear Shaver

PLANERS

36"x36"x8' Woodward & Powell

TURRET LATHES

No. 2 American Brass Lathe, M.D.
No. 2 Brown & Sharpe, Wire Feed
No. 1-A W & S Univ. Speed Selector (1941)
No. 5 Jones & Lamson Univ.
18" Libby—3½" Hole—M.D.

GRINDERS

No. 22—12" Heald Rotary Surface
10"x24" Landis Universal, M.D.
No. 34 Abrasive surface
No. 2 Cincinnati Tool & Cutter
Norton Motor Driven Grinders practically all sizes from 6x18 to 24x240.

APPROVED WAA DEALER CHI-9

HILL-CLARKE MACHINERY COMPANY

651 Washington Boulevard
Chicago 6, Illinois

Machine Tools Rebuilt By Botwinik in One of the Country's Largest Plants Give You Extra Value at Minimum Cost

1—Bridgeford 36"x56', 15 speed, grd. hed. Eng. Lathe, M.D., AC elect. equip., power rap. trav. to carr., compound rest. 2 steady rests, sw. 38" over bed, 26" over carr., dist. betw. cens. 48'.

1—American 24"x12', 12 speed, Eng. Lathe, M.D., sw. over bed 27½", dist. betw. cens. 84".

1—Whitcomb-Blaisdell 24"x10', QCG, DBG, Heavy Duty Eng. Lathe, M.D., dist. betw. cens. 48", sw. over bed 26".

★ (Brand new) Bradford 12'x6" Lathe, art. sw. 14½", dist. betw. cens. 30", timk. bear. spin.

2—Hendey 16"x10' Med. E.B.M., 18 speed, M.D. Eng. Lathes, sw. 16-7/16", dist. betw. cens. 75", with taper attmt., Ser. No. over 25,000.

2—Cin. No. 2 Centerless Grinders, very latest type, Filmatic bear., capac. bar. wk. ⅛" to 2" diam., 18' long., very lat. type.

B. & S. 1½A Univ. Miller, tbl. wkg. surf. 36¼"x 8¼", power feed: long. 20", trans. feed 7", vert. 18".

1—Van Norman No. 3 Duplex Miller, high speed mill. attmt., 12 speeds, tbl. wkg. surf. 48¼"x10", power feed: long. 32", cross 12", vert. 18⅞".

1—Milwaukee 2K Pl. Hor. Miller, very late type, tbl. wkg. surf. 56"x12" power long. feed 28", cross 10", vert. 17", spin. speeds 15 to 1500 R.P.M.

1—Putnam 84"x84"x40' Dbl. Hous. Planer, Revers., M.D. and controls, 2 heds. on cr. rail, 2 side heds., just taken out of service.

1—Cin. 78"x56"x22' Planer, M.D., rap. trav., 2 heds. on cross rail, 2 side heds.

1—Cin. 30"x30"x8' Planer, 2 heds. on cross rail, 1 side hed., motor driven.

1—Amer. Fndry. & Mach. Co. 30"x30"x10', 1 hed. on cross rail, 1 side hed. Openside Planer, M.D.

Bullard 24" and 30" New Era Type Vert. Bor. & Turn. Mills, M.D., capac.'s and diams. 26" and 28", hghts. under cross rail: 20" and 24", side heds.

2—Bullard 36" "Spiral Drive" Vert. Bor. Mills, high speed, very latest type, Ser. Nos. over 16,000.

1—14' Sellers, 2 heds. on cross rail, elect. equip.

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National Bent Shank Nut Tappers—Battery of ⅝" and ⅞" Machines.

2 Landis ¾" Bolt Formers and Threaders, M.D.

1 National ½" to 1" Hot Bolt Head Trimmer

Woodward & Powell 42" x 42" x 36 ft. 4 Head Planer

Cincinnati 36" x 36" x 16 ft. Planer, M.D.

1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

National Machinery Exchange

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IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 10 H.P. motors and controls, forced feed lubrication. 21x27 bolster 4½" stroke. In both Single and Double Action Models. Like new.

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35 ton Bliss Gap Frame Punch Presses, 4-8" stroke, latest design.

1—#87 BLISS Press, 175 Ton cap. 32" stroke, late model.

#666 Toledo, Knuckle Joint Press. 1000 ton cap. 37x21 bolster, 5" stroke, very good condition, all electrical equipment.

SPOT WELDERS IMMEDIATE DELIVERY 5-300 KVA, Brand new. 5 year guarantee.

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CINCINNATI BICKFORD 3'11" Column Radial Drill (Super Service)

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ATLANTIC #2 Automatic Surface Grinder.

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SMALLEY GENERAL THREAD MILLERS, 24" swing 36" centers. (15)
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Lees Bradner Model 40 Thread Millers
32"x14' Engine Lathe
36"x14' Ingersoll Slab Miller

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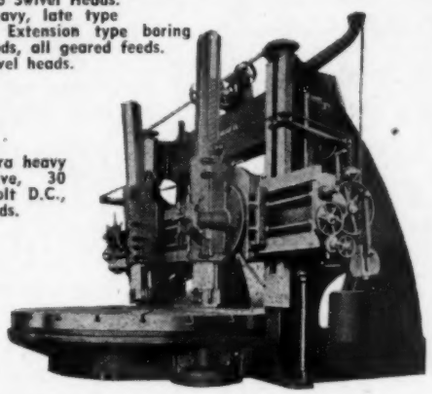
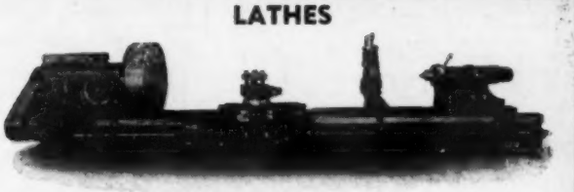
BORING MILLS

9" Bar BETTS Horizontal floor type, 50" face plate 6'—vertical travel, modern, 4-motors.
3" Bar Universal TRI-WAY Horizontal, P.R.T.
3⅛" Bar No. 32 GIDDINGS-LEWIS
4½" Bar N.B.P. Table type.
24" New Era, BULLARD
54", 60" and 72" COLBURNS, two heads.
72" KING, Two Swivel Heads.
14' BETTS, Heavy, late type
14-20' N-B-P Extension type boring 2 swivel heads, all geared feeds.
16' NBP 2 swivel heads.



12' BETTS Extra heavy Double Drive, 30 H.P., 230 volt D.C., 2 swivel heads.

LATHES



48"x40' SIMMONS Heavy Geared Head Engine Lathe, AC or DC (new 1942)

30"x18' AMERICAN 12 Speed, G.H.
30"x23' AMERICAN 12-speed, G.H.
36"x32' NILES, "Timesaver".
36"x32' AMERICAN, 16 speed geared head
42"x34' LEBLOND late type.
48"x40' SIMMONS, Geared head.
60"x30' NILES Heavy Duty Geared Head, M.D. (Built 1942).
60"x31' (20' centers) NILES, 16-speed G.H. Lathe (New 1942).
90" PUTNAM Driving Wheel Lathe with journal truing and Double Quartering.
No. 2-H LIBBY, Full Universal Cross Feeding Turret.
3-AL GISHOLT, Hardened Ways.

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MILLING MACHINES
Latest Type and Design

#2G Kempsmith Universal—1943
#2 Cinc. Plain H.S.—Dial Type—Horiz.—1941
#2K K & T "Milw" Horiz.—plain—1942
#2S Van Norman plain—Horiz.—1942
#3 Cinc. Plain H.S. Dial—Horiz.—1942
Nichols Hand—1942
#3KM K & T "Milw" Vertical—1942
#3K or #3KM Vertical Attachment—NEW

Other Tools in Stock

DRILLS:—3'11" Carlton Radial—24 speeds—1942
4-spdle Sipp—T & L
4-spdle Allen—T & L
D5 Natco Multiple

GRINDERS:—14x14x48" Abrasive Surface
#2 Cinc. Centerless "FILMATIC"—1942
#25 Heald Rotary Surface

LATHES:—14"x6' Hendey—Yoke Head—QCG
16/20x58"—Lodge & Shipley—Sel. Hd.—1942
16x54 Reed-Prentice—16-speed—1941
16x6' Sebastian—G.H.—NEW
16"x6' Monarch—QCG
18"x16' Monarch—QCG
18"x8' Flather—QCG
24"x10 Blaisdell—LCG

MILLING MACHINES:—#2 Cinc.—Universal—MD
Miller & Crown.—Hand—MD

SHAPERS:—16" Ohio Crank—CD
16" Gemco—NEW
16" Stockbridge—CRANK—CD
7" Logan—NEW

MISCELLANEOUS:—#1A Gorton Etcher and Engraver
Gear Hobber—Pfauter #0—14" Univ.
Metal Saw—#4B Cochran-Bly
36" Pexto Power Squaring—MD
Band Saw 8x16 Kalamazoo—NEW
EL—Die Filer Harvey "Butterfly"—NEW
Saw 6x6 Racine—Power
Press—12-ton—NEW—U.S.

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POWER PRESSES

Bliss #304, 56 tons, 8" str., 18x18"
Bliss #6, 125 tons, sgl. & dbl. act. 24x30"
Bliss #7, 180 tons, sgl. & dbl. act. 24x36"
Bliss #7, 88 tons, 4" to 8" str., Horning
Cleve #10S, 90 tons, 8" str. 22x22"
Bliss #87½, 200 tons, 16-30" str., 28x28"
Bliss #88, 250 tons, 10" to 30" str., 29x29"
Clearing F1250—22, 250 tons, 22" str., 32x42"
Toledo 59½S, 500 tons, 8" str. 31x31"
Bliss 26A, 800 tons, 5" str. Knuckle
Clear. K800, 800 tons, 6" str. 42x42"
Vers. 40K, 1000 tons, 4" str. 36x36"
Natl. Maxi. #6, 2000 tons, 12" str.
Fed. #0—7 tons, dial feed (new)
Bliss #58, 18 tons, 5" str. 12½x13½"
Fed. #3, 30 tons, 8" str. 14x24"
Ferr. C22—Duplex, 15 tons, 5" str. 18x24"

Lathe, Simmons 48"x20' c-c
Lathe, Pittsburgh, 50"x14' c-c
Planer Cinc., 60"x60"x14', H.D., dbl. housing
Boring Mill, Betts 96", 4 Heads
Ceco Stamps 24"x30", 36"x48", 48"x48", 48"x66", 60"x156"
Rotary Shear ¾" Model #50A Quickwork
Pneumatic Drop Hammer, 36"x48", 3000 lb. Head
5" Acme Upsetter (1944)
300,000 lb. Drawbench—20,000 lb. Drawbench
HYDRAULIC PRESSES 75 tons to 5000 tons

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NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders.
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No. 2F Foster Fastermatics
52" King Boring Mill, DC motor drive
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QUALITY TOOLS

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⅞" & 1¼" Cone 4 spindle
1⅛" Cleveland 4 spindle
2"x18" Cleveland Model B
12"x63" & 14"x19" Fay
14"x18" Monarch Magna-Matic
No. 454 New Britain chucking
Gisholt simplimatic

BORING MILLS

3½" bar Universal horizontal
3½" bar Giddings & Lewis horiz.
4¾" bar Giddings & Lewis No. 300 Floor type
100" Niles Bement Pond heavy pattern
96" Cincinnati Massive Pattern
60" Colburn
53" Niles Bement Pond
24", 36", 42" Bullard V.T.L.
No. 112 C Excello precision borer

BROACHES

No. 2 S LaPointe
Twin 10 Oilgear duplex
VI Foote Burt duplex surface
3XA Oilgear
HP50 Lapointe
12 ton V50 American vertical
30 ton V48 American vertical

DRILLS

18" Walker Turner radial
24" No. 3 Leland Gifford 4 spdl., P.F.
21"x74" Munson double end
No. 005 Garvin double end
4-spdl. #3 Leland Gifford
21" & 24" Cincinnati upright
24" No. 25 Foote Burt Heavy Duty
34-spdl. #30 Natco

GEAR HOBBERS

Nos. 8H, 12H & 16HS Gould & Eberhardt
Nos. 3 & 12 Barber Colman
Mod. T Barber Colman taper spline
No. 130 Cleveland Rigidhobber
Nos. 1, 5A & 5AC Lees Bradner

LATHES, TURRET

Nos. 4 & 5 Warner & Swasey universal
Nos. 3-B & 5 Foster universal
Nos. 3 & 5 J. & L. universal
16"x8' South Bend
Nos. 3 & 5 Foster
24" & 42" Bullard vertical
28" Gisholt
3"x36" & 4"x34" Jones & Lamson

PRESSES

12 ton U.S. OBI
No. 4A Bliss horning
150 ton No. 661 Toledo coining
8 & 20 ton General Flexible
35 ton Metalwood straightening
1000 ton Lake Erie hydraulic

UPSETTERS

1" National
1½" & 2" Acme
3" National

MISCELLANEOUS

#10-D Moline Cylinder borer
#112-C Ex-Cell-O precision borer
1220 Cu. Ft. Sullivan compressor
Nos. 2 & 3 Cincinnati centerless grinders
No. H-1 Micromatic Hydrohoner
#211 Barnes honer
No. 9 LeBlond Multicut lathe
6", 8" and 15" Sundstrand automatic stub lathes
#12-B Pratt & Whitney profiler
Model J Radiac abrasive saw
4" Stevents die slotter
16" Bement Miles slotter
#2 Garvin tapper
90 KVA Fisher body seam welder

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MILES MACHINERY CO.
SAGINAW, MICH.

27" x 144" Between Centers
LeBLOND Heavy Duty
ENGINE LATHES

Manufactured in 1942

Immediate Delivery—Excellent Condition

Priced less than Clayton Formula

Specifications:

Geared Timken Head, Multiple Vee Belt Motor Drive, 20 H.P. Motor Mounted on top of head, regular multi disc clutch in drive pulley with apron control from carriage; pump and piping; rapid power traverse to carriage; 220/440 volt, 3 phase, 60 cycle current motors.
Actual swing over the ways 30½".
Swing over cross slide 19½".
16 spindle speeds from 6.5 to 400 RPM.
56 feeds from .004 to .500.
Threads per inch from ⅜ to 46.
Thread Chasing Dial
L-3 Direct Application taper key drive type spindle nose.
One or two carriages.

Wire or write

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HORIZONTAL
BORING MILL

No. 45 GIDDINGS & LEWIS Horizontal Boring Drilling & Milling Machine, Table Type 5" spindle, No. 6 Morse Taper, Table 72"x36"—20 HP—3/60/220 motor drive.

Immediate delivery from stock

O'CONNELL MACHINERY CO.
1825 Niagara St. Buffalo 7, N. Y.
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Three #35 Excello Thread Grinders with all attachments and accessories: in excellent condition: three years old: operation hours less than 1,000.

Price for Immediate Sale $6,500.00 Each.

West Coast Machine & Tool Co.
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FOR SALE

30,000

29/32-INCH No.1

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DIXIE CONSOLIDATED
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FORGING MACHINERY
1942 and Later

40 Steam Drop Hammers 2000 lbs. to 35,000 lbs.
10 Trimming presses with side shears 125 tons to 720 tons M.D.
15 Straight Side Presses 225 tons to 1200 tons.
Hydraulic Presses 750 tons to 2400 tons.

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MASSILLON, OHIO PHONE 8180

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REYNOLDS

WANTS TO BUY...

1 No. 28-60 Cincinnati Hydro-Tel Vertical Miller.

6 Swiss-Type Automatic Screw Machines.

1 No. 3 26" B & S Automatic Gear Cutter.

15 25 Ton Inclinable Power Presses—Late Type.

1 No. A 3-1½ Niagara 50 Ton Inclinable Power Press.

1 No. 18 Blanchard Grinder with 36" Magnetic Chuck.

No. 20 and No. 30 Waterbury Farrell Foundry Thread Rollers.

No. 00G, No. 10G and No. 2G B & S Automatic Screw Machines—Motor Driven—1940 or later.

2 Boye and Emmes or equal 24"x11" (C-C) Engine Lathe.

If you have surplus machinery for sale send us a list of the machines available, NOW!

REYNOLDS MACHINERY CO.
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WANTED TO BUY

Power Shear—10' wide, capacity up to ⅜" mild steel
Shaper—24"
Turret Lathe—Saddle Type 15"—3-jaw Scroll Chuck

KEWAUNEE ENGINEERING CORPORATION
KEWAUNEE WISCONSIN

Want to Rent or Buy
A HYDRAULIC PRESS

At least 700 tons Capacity, with horizontal table. Also

A HIGH FREQUENCY INDUCTION UNIT

for steel melting, 15 K W or more. Would like to find both together but would consider separately. Prefer to rent but would buy one or both. To be used for experimental work. Can arrange use so as not to interfere with regular work. I have no shop of my own and would also like to hear from someone who might need one or both of these units and would like to have me install them in his shop if I buy them. Would consider any place accessible to N. Y. C. *Tell me your proposition.* Write to **X. V. DUGAL, 363 W. 42nd St., N. Y. C.**

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PLANER — LATHE — DRILL

48x48x16 ft. to 20 ft. openside planer—modern design.
36 swing x 20 ft. between centers modern design lathe.
4 ft.-11" column modern design radial drill.

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THREAD GAGES — PLUG AND RING

Slightly used. NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.
LESS 75 Percent Discount.

ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".
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40% discount from List Price.

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B-1	8.00	"	"	"	"
C-1	8.00	"	"	"	"
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D-2	8.00	"	"	"	"
E-1	8.00	"	"	"	"
E-2	8.00	"	"	"	"
F-1	12.00	"	"	"	"
F-2	12.00	"	"	"	"
J-1	18.00	"	"	"	"
J-2	18.00	"	"	"	"
M-1	24.00	"	"	"	"
M-2	24.00	"	"	"	"
N-1	32.00	"	"	"	"
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(3) Practically New (1943) Model #49 New Britain Gridley four-spindle Chucking Machines, Chuck Vise 9".

ORIGINAL COST OF $15,000 each.

Our Price for quick removal . . . $1750.00

Machines absolutely equal to new. Can be inspected in our warehouse.

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Power Shears 52" & 72"
Power Presses, 5, 10, 18 & 30 tons, O.B.I.
Spot & Arc Welders
Abrasive No. 1½ Surface Grinders, M.D.
Racine 6 x 6" Hacksaws, M.D.

AARON MACHINERY CO., INC.
45 CROSBY STREET NEW YORK, N. Y.

LATE RAM TYPE TURRET LATHES

#5 W & S Univ., New 1942
#4 W & S Univ., New 1942 & 1945
#3 W & S Univ., New 1942 & 1943
#3 J & L Univ., New 1942 & 1944
#1 B & S Screw, New 1945 (7)

BENNETT MACHINERY CO.
Hudson Terminal, 30 Church St., New York 7, N. Y.

Belt Cutters, 1"-1½"-2"-2½"-4" Acme, Landis.
Boring Mills, 24"-36"-42"-52"-72"-90".
Drills, Radial 6' Cin.-Bick. 5' Carlton.
Lathe, Turret 3-A W. & S., S. P. D.
Millers, Plain No. 2 K & T, No. 4 Cin.
Planer 36"x36"x12' Powell 4 Hds.
Profiler, #13 P. & W., B.D.
Shapers, 16"-20"-24"-36".
Shaper, 36" Morton Draw Cut.

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Classified Advertising Division
AMERICAN MACHINIST

You can match these results if you use

"cutsall" STEP MILLS

Material
1020 Hot Rolled Steel
—90 Brinell
Feed
8" per min.
Speed
556 r.p.m. 920 SFPM
Depth of cut
¼"
Tip material
Carboloy
Power available
7½ H.P. on spindle
Performance
6" "Cutsall" with 80 lb. flywheel. Cutting action free and even, produced mirror finish.

CARBOLOY TIPPED TOOL-BIT-TYPE

Material
1020 Hot Rolled Steel
—90 Brinell
Feed
8" per min.
Speed
556 r.p.m. 920 SFPM
Depth of cut—¼"
Tip material
Carboloy
Power available
7½ H.P. on spindle
Van Norman #2 Heavy Duty Milling Machine
Performance
6" "Cutsall" with 80 lb. flywheel. Cutting action free and even, produced mirror finish.

Sound design features and precise construction are the reasons behind the production figures established by Lovejoy "Cutsall" Step Mills. They have rigid, forged steel bodies, built to use most effectively the cutting qualities of carbide. The tool-bit type blades have extra large Carboloy tips that can be ground easily to obtain positive or negative rake. Each of the blades can be individually adjusted and securely locked in the housing by two set screws. All blades are interchangeable and fit either the 6", 8", 10" or 12" diameter sizes.

Flywheels are recommended for use when milling steel. Lovejoy now offers a complete line of flywheels, and will be glad to help you pick the correct one for your particular job.

The production performance of Lovejoy Cutsall Step Mills is worth investigating — complete details on these most modern metal cutting tools are contained in the new "Cutsall" catalog. Mail coupon today for your free copy.

Please send me the new "Cutsall" Catalog A. M.

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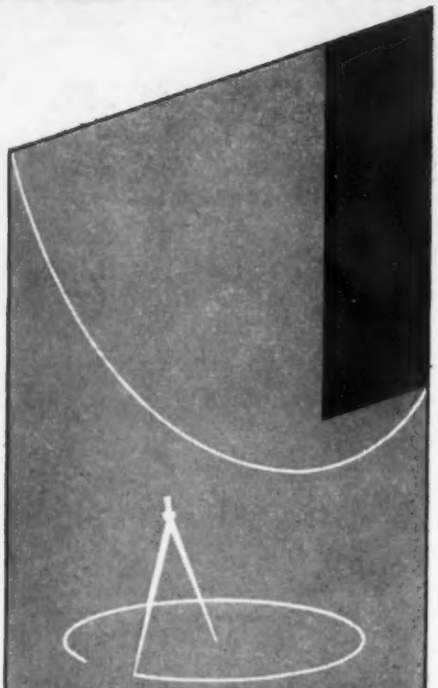

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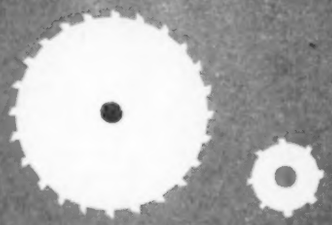

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Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

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SPRINGFIELD, VERMONT, U. S. A.

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Standard or Special

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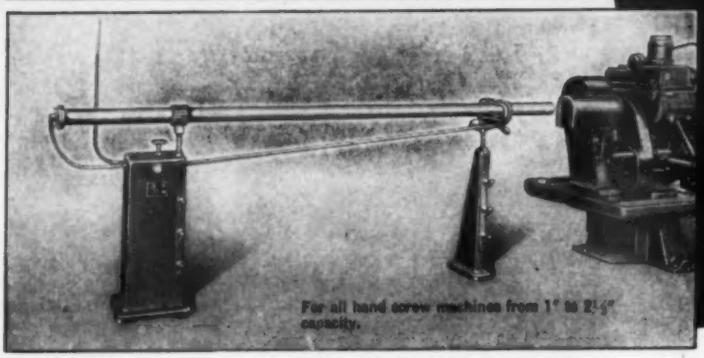

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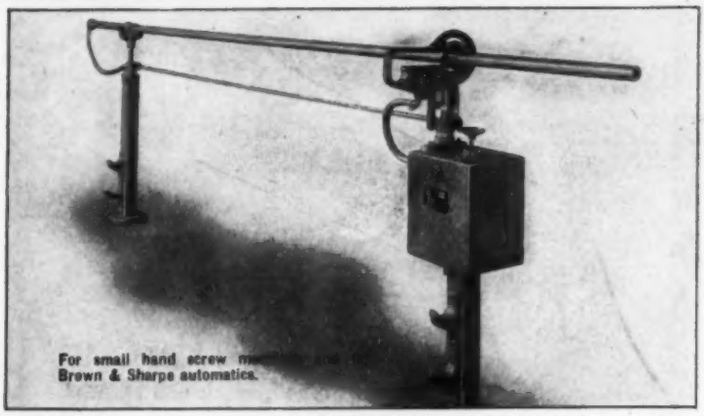

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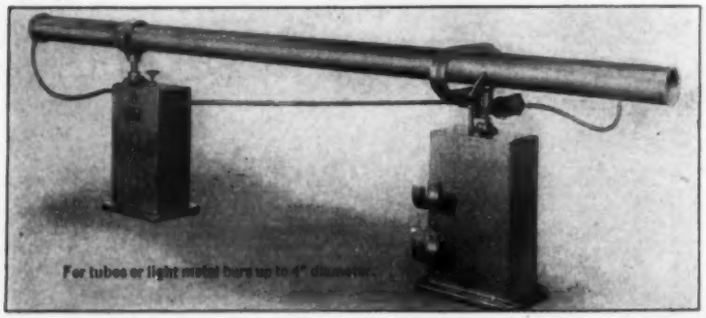

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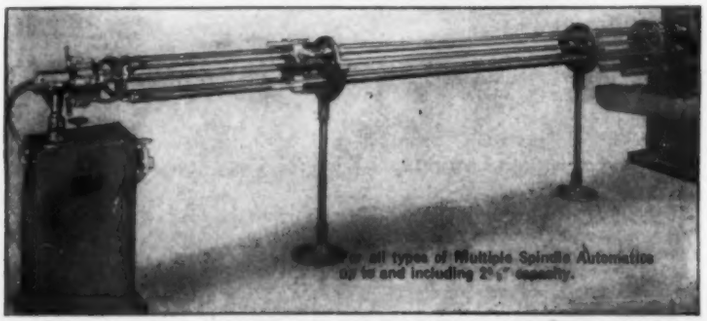

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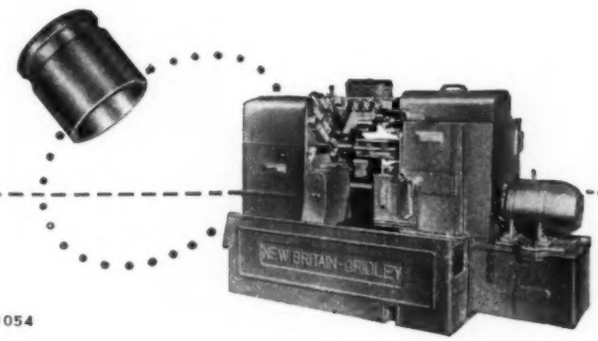

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Automatics

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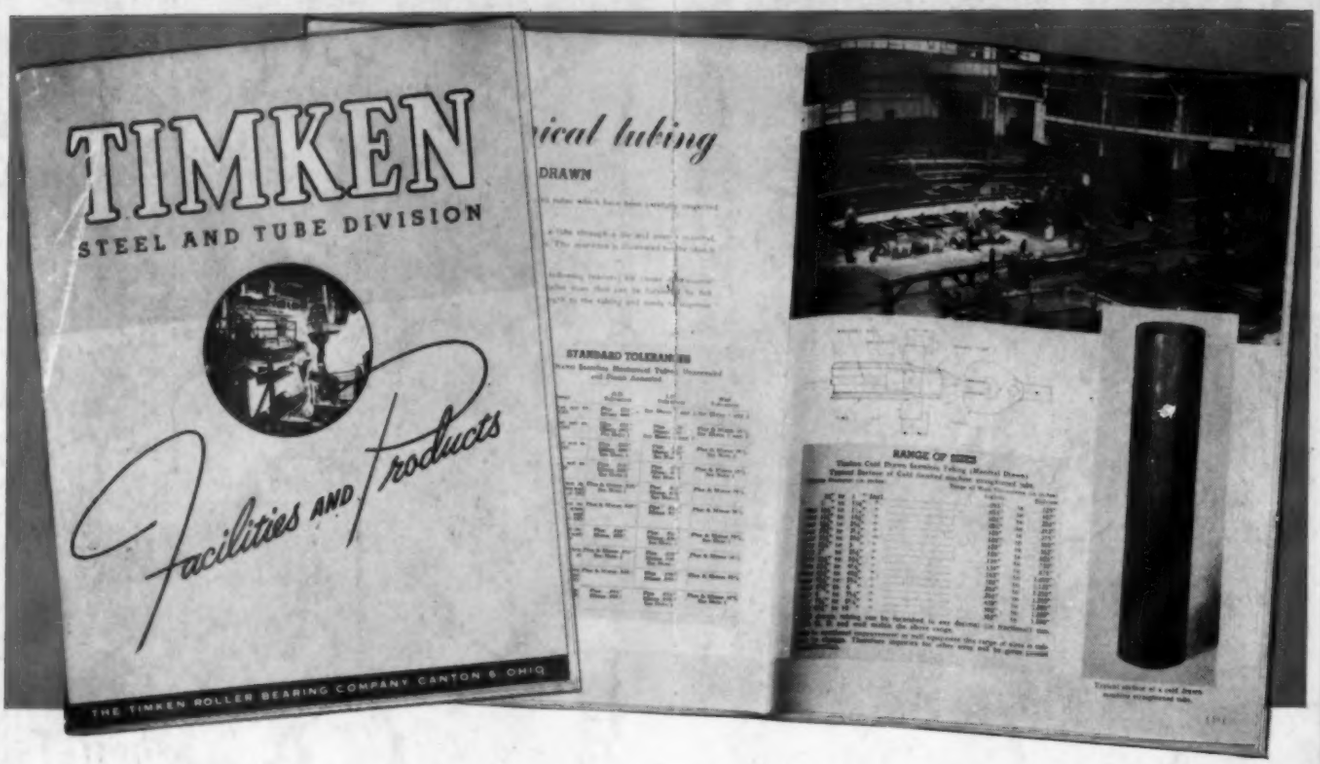
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT



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